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INDUCED PNEUMOTHORAX IN PULMONARY TUBERCULOSIS[1]

ITS PRESENT STATUS

WILLIAM N. BEGGS

Denver, Colorado

Although we might not unjustly have anticipated that before now the pendulum of professional comment and criticism as to the value, the proper position, the indications, and the contraindications of induced pneumothorax in the treatment of pulmonary tuberculosis would have indicated very approximately a consensus of opinion, such is not the case, although Sachs (1) says that "pneumothorax therapy is gradually finding its defined place in the treatment of cases which do not yield to other methods." While this about states the views of many, nevertheless the amplitude of oscillations of opinion is still very great.

According to Rist (2) and a not insignificant number of other contributors to the subject, "Collapse therapy is evidently the best and, in the present state of things, the only effective treatment we can oppose to progressive phthisis." The latter clause of this statement is certainly true and should ever be borne in mind in attempting to apply the principles of pneumothorax treatment to any individual case.

Opposed to this view there are also many who agree with Kuhn (3) that "pneumothorax treatment is only the last resort (*ultima ratio*) for severe, otherwise hopeless cases." In this connection, I should like to repeat (4): "In tuberculosis, to wait for a 'last chance' is to wait for a lost chance. There are as many consumptives who die as the result of neglected opportunities as from any other cause."

There are still others who never employ this method and openly oppose it. Many of these have had absolutely no experience with it. They, perhaps, may be arrayed with those whom Woodcock (5) flays, saying: "To another kind of censor I confess an antipathy—the ultra-clever critic who in the very order of things meets with a limited executive success in his own attempts and is temperamentally obliged to use his ability of expression to excuse his own failures and belittle the work

[1] Read before the Denver Tuberculosis Study Club, May 24, 1917.

of the more fortunate." As Edgar Allan Poe (6) might have said, they are "mere doubters by profession—an unprofitable and disreputable tribe."

We must recognize the fact, however, that to-day pneumothorax therapy is employed by but comparatively few, and that the vast mass of the profession regard it—if they ever do think of it—with the same degree of indifference, discouragement, and disappointment with which they have come to regard all methods of treatment of phthisis except the so-called hygienic (for which they have no responsibility as regards results) and the expectant—the expectation of a fatal termination.

We may be justified in a little inquiry as to the reasons for this attitude of indifference, discouragement and disappointment. In the first place, so many of the proposed "cures" loudly proclaimed by both the laity and the profession have proved to be such utter fiascos that the enthusiasm for further effort for the benefit of the consumptive is already dulled by the anticipation of failure.

Furthermore, very many, and perhaps properly so, as this is not a treatment to be employed by the untrained, have not the courage to make use of it. In a chronic affection with infrequent fulminant indications the stimulus to surgical interference is seldom regarded as urgent. It is so very much easier to give a few prescriptions for symptomatic conditions, all the time wishing for the best but expecting the worst.

Another, probably more cogent reason than either of these, is the almost universal failure to hold our attention to a constant recognition of the actual character of the individual case to which we have applied this treatment and what we really have expected to accomplish by it. We are constantly forgetting what our actual original prognosis has been. We have, all of us, repeatedly employed pneumothorax treatment for, at the time, definitely palliative purposes only, in cases in which we felt certain, so far as our judgment and experience justified, that no measure whatever offered any reasonable expectation of a cure and, as time went on, we have forgotten that we had hoped for nothing but amelioration, and but little and temporary at that. We have forgotten this and we are criticising the treatment by the degree in which it has fallen short of an ideal restoration to perfect health.

However, we cannot ignore the insistent demand of the profession for information as to the actual results of this method of treatment. Some have attempted to answer it in a statistical way. Thus Sachs (1)

gives the following table of the "immediate" results in 1108 cases (out of 1145) reported by twenty-four American observers:

	NUMBER OF CASES	PER CENT	TOTAL PER CENT
Failure (failure 152; very small amounts, 10)	162	14.6	49.1
Unimproved	203	18.3	
Dead	180	16.2	
Improved	323	29.2	50.9
Quiescent	119	10.8	
Apparently arrested or arrested	105	9.5	
Cured	16	1.4	

It might be observed here that the terms "arrested" or "apparently arrested" and "cured" are very unfortunately used in connection with pulmonary tuberculosis because of the false sense of security they induce. To the patient they almost universally convey the meaning of an actual and absolute cure, and to the profession at large the implication is practically the same. As for a "cure" there is no man who can tell when a cure is so established that there is no further danger of a fresh outbreak from previously existing foci. The same is true of "arrest" and "apparent arrest." Strictly speaking, in tuberculosis, there is no arrest until a cure is established. We all know that as long as there are any active tubercles in existence fresh ones are being formed, either in their neighborhood by contiguous infection, or at a distance by metastasis, even though we cannot demonstrate them by physical or symptomatic signs. We have no right to a more favorable designation than improved or, at most, "clinically quiescent."

Taussig (7), in 1913, said: "The cases of pneumothorax reported statistically, or in some detail, now amount to about a thousand. The immediate results are almost always good . . . . with a symptomatic cure of 40 per cent . . . . In a word, although there may be differences of opinion regarding details, it is clear that this treatment greatly improves the outlook for the advanced consumptive." He also says that "the nature of the case makes a statistical summary of the final results not only difficult, but in many respects misleading."

I have quoted these two reports because of the large numbers contained therein. There are many others, some of them giving greater detail in the consideration of the individual features, which might well

be considered. I shall quote only from three or four for special purposes which will appear evident. Shortle (8) gives the following:

Number of cases inoperable	25
Number of cases with sufficient collapse	79
Total	104

We may observe here that in determining what proportion of cases of pulmonary tuberculosis may be suitable for induced pneumothorax treatment it may be proper to consider those cases in which there are failures because of inability to secure an available gas pocket on account of adhesions. They should, however, be entirely excluded in any statistical study of the results of this method because in them this treatment has not been used at all; it has been attempted but not used. There is a difference as well as a distinction here. Only the preliminary steps have been taken. It would be just as rational, in orthopedic surgery, for example, in studying the effectiveness of any particular fixation method to include those cases which have refused to tolerate the restraint. This would make quite a difference in the percentage reports of the failures and successes, partial or complete.

Of Shortle's 104 cases a crucial comparison is that of the 79 cases operated upon and the 25 inoperable cases, all presumably of the same class as regards condition before treatment, as given in this table:

Cases operated, 79	*per cent*		Inoperable cases, 25	*per cent*	
Dead	44.3	46.8	Dead	64	96
Worse	2.5		Worse	32	
Working and good condition		51.9	Improved		4

The contrast certainly calls for reflection.

Hansen (9), quoted by Parfitt and Crombie (10), reported the first 100 of Saugman's cases, most of whom had undergone sanatorium treatment. In 31, adhesions prevented collapse: in 24, pneumothorax was induced as a last resort or only as a palliative measure; in 45, bilateral cases the treatment had lasted at least a year and a half. The first group gives a fair control for the last group, as, in extent and activity, the groups were comparable. The results were as follows, six of the inoperable cases not being reported:

Operated cases, 45	*per cent*		Inoperable cases, 25	*per cent*	
Dead	26.6	39.8	Dead	40	76
No improvement or worse	13.2		Worse	36	
Improved		55.5	Improved		24

Comment is hardly necessary.

Sloan (11) reports of 43 of his and Hamman's patients treated from three months to three and one-half years that 18, or 41.8 per cent, are dead; 8, or 18.5 per cent are doing poorly; total, 60.3 per cent. Of the others, 11, or 25.5 per cent, are doing well and working part time; and 6, or 14 per cent, have resumed all of their former business and social obligations, a total of 39.5 per cent.

Let us compare this report with that of Wolman and Hirschman (12) given at the same meeting of the Laennec Society, concerning ex-patients of the Maryland State Hospital with a few from private sanatoria, consisting of all of the ex-patients, without selection, who could be traced up to the time of making the report. Of the 141 patients there were:

	per cent	
Dead	51 or 36.1	or 78.6 per cent unimproved
Living, worse	44 or 31.2	
Living, not definitely worse	16 or 11.3	
Improved	30 or 21.2	

Nothing is said as to their condition on entering the hospitals, but it is hardly to be assumed that they were worse than those to whom the pneumothorax treatment had been given. This is truly a sorry showing for the results of the ordinary routine sanatorium treatment as compared with pneumothorax.

On the other hand, there are very many, and among them those who have had the greatest experience, who believe that statistics do not give the truest criterion for a judgment as to the value of pneumothorax treatment. Thus Parfitt and Crombie (10) say: "Results cannot well be given statistically . . . . Forlanini (13) declines to tabulate his one hundred and sixty-three cases. Triumphant recoveries have been obtained in otherwise hopeless cases. . . . . The experience of twenty years has justified his anticipations." They go on to say: "With many handicaps and limitations the results of artificial pneumothorax have been remarkable and often dramatic. . . . . We feel enthusiastic about the treatment and its possibilities."

Jessen, as quoted by Kendall (14), "claims that statistics on the results of treatment with pneumothorax are of little value because the conditions of the patients at the application of the pneumothorax were and always will be too diverse."

The opinion of Rist (2), is that "there are few therapeutic results

more striking and more gratifying for the physician than the complete transformation caused in a tuberculous patient's life by a successful pneumothorax. In a great number of cases one is entitled to speak of real clinical recovery." If we can accept as representative the comparative statistics quoted before, there is but one other therapeutic agent to which the latter statement can be applied as true, namely, climate.

In considering the question of "clinical cure" there is an inclination to lay a great deal of stress upon a complete restoration to a normal working capacity. Thus Spengler (15) reported fifteen of the series of Brauer and Spengler's (16) 102 cases of hopeless outlook, who showed clinical cure and permanent results according to the following standard:

1. The pneumothorax had been discontinued at least nine months.
2. Fever, cough and sputum were absent (or if there was sputum it was free from bacilli).
3. All patients were fully capable of work.

Similarly, the ability to work has been dwelt upon in some of the statistics I have quoted. That may be a very desirable result to obtain, but it is not a just requirement for a "clinical cure." It can, for example, be readily understood that in very many surgical conditions in which operative procedures have resulted in the restoration of the patient to health there has been no normal working capacity following. Thus, a patient may go on limping through life with a stiff knee following a diseased articulation and still be regarded as in perfect health. Every surgeon would regard a complete restoration, anatomical and functional, as the highest tribute to his art, but none would consider that an essential condition for the employment of an indicated treatment.

Further, the measure of the value of pneumothorax treatment is not the number of cases of "cure," "apparent cure," "arrest," or "apparent arrest" only. They form a valuable asset in the balance sheet of consideration, but they are not all of the assets, nor even the greatest portion. A careful consideration of any set of comparative statistics will show that there is a very definite average lengthening of life among those to whom it is possible to administer this treatment with a satisfactory collapse. What the statistician cannot recognize is a matter of common experience with the clinician; namely, that even without a lengthening of life there is frequently a marked amelioration of symptoms, that this amelioration is more frequent with the lengthening of life, and that this amelioration is the more marked, *pari passu*, with an in-

creased prolongation of life. No man can observe the increased comfort and the consequent happiness in even the hopeless case without appreciating that this method of treatment has a distinct and decided value.

We are justified in questioning the value of the "averages" in statistics. We certainly must not lay too great stress upon them. The features for the formation of a correct judgment are not infrequently submerged in the column of figures. Pulmonary tuberculosis is not by any means a typical, self-limited disease with a sharply defined symptomatology and average of duration. We do know, however, that the trend of the advanced case is toward death with an ever increasing rapidity. A few positive observations of distinctly varying phenomena are of vastly greater value than any number of negative. A few startling accidents will do more to direct attention to the dangers to be avoided than will an entire humdrum existence with purely academic consideration. Correspondingly, a sufficient number of improvements, in cases of a type ordinarily justifying only bad prognosis, will outweigh any amount of skepticism and criticism. The only proper course to take is to define, as closely as possible, the cases probably adaptable, the knowledge necessary for the application of the treatment, and the judgment requisite for carrying it out to the best advantage of the patient.

There is one indication for pneumothorax treatment upon which practically all observers are agreed. All cases of severe, repeated and persistent hemorrhage call for lung compression, no matter how early the stage of involvement of the lung. This is an urgent symptom and one should not wait for too great severity or too great persistence. We all know how a hemorrhage has often been the determination of a fatal exacerbation of the disease if it was not itself directly fatal. I have seen a number of cases which, it seemed to me, could have been saved by the administration of a pneumothorax, and also a number in which it seemed that death, impending death, was avoided only by its administration. It should be emphasized that in recurrent hemorrhagic cases the lung should be compressed early to anticipate aspiration pneumonia, as well as to forestall a directly fatal repetition of the bleeding. If an aspiration pneumonia has already set in the pneumothorax will do but little, if any, good.

Aside from hemorrhagic cases, the opinions of the operators as to when and in what kind of cases pneumothorax treatment should be employed are at great variance. Except for Murphy and his followers (17), (18),

(19), (20) practically all have used it for very advanced cases only, and almost all of them have recognized that it should be used earlier. According to Kuhn, (3), "the basal reasons for placing the lung at rest are present in only exceptional cases." In line with this is the statement of Hawes (21): "The great majority of the profession realizes that it plays only a comparatively small part in the treatment and that it should be used only when the patient can be under absolute supervision over a long period of time." It might also be added that he should be under the care of one with the requisite amount of skill and judgment.

In direct opposition to this, and not without some good reason, is the position of Murphy and those who have worked with him. Murphy (19) in 1913 said: "The time for giving the treatment is exactly the same as for treating surgical tuberculosis in any portion of the body, which means that it should be begun in the earliest stage of the disease, or, if possible, soon after mixed infection has occurred. . . . . The earlier the treatment is begun, the better the prognosis." The next year Murphy and Kreuscher (20) affirmed: "Pulmonary rest is the initial indication in the initial stage of pulmonary tuberculosis and can be safest and best secured in the incipient stages. . . . . It is exactly the appendix proposition over again—namely, that the physician and surgeon are waiting for the disease to 'ripen,' to have it rich and juicy before instituting sufficient measures for its cure. . . . . From an experience of nearly 500 cases treated by Murphy and his associates . . . . . we conclude that the artificial pneumothorax should always be made in every case of pulmonary tuberculosis when there is no absolute contraindication." Truly the pendulum does not yet rest pointing to the nadir.

My own experience as assistant, principal, or consultant in about one hundred cases of pulmonary tuberculosis treated by induced pneumothorax, almost all of them in advanced stages, convinces me that a decidedly earlier treatment by this method is very much to be desired. There are many reasons for this. The beneficial effects are directly due to the compression of the affected lung (10) or the peccant part thereof, and the clinical results will depend upon the extent of the pneumothorax and the compression obtained (14). This deserves emendation to the extent that if there be effective pressure upon that portion of the lung which is giving rise to the intoxication (for the intoxication is the noxious agent except in case of hemorrhage) there may be relief or cure

even though there is not a complete compression of the entire lung. The principal and almost only cause of failure to secure a satisfactory collapse of the lung is the existence of pleural adhesions. It is a matter of universal recognition that the further the disease has progressed the greater the liability to find extensive adhesions or even total obliteration of the pleural space, even though either may exist in early cases from previously occurring pleurisies. Hence, the more advanced the case the greater the danger of inability to apply this method of treatment.

In my opinion, the great objection to recommending pulmonary collapse very early in the disease is the frequency with which pleural exudates occur in the course of the treatment. This happens in at least 50 per cent of the cases which are observed long enough and carefully enough. This has been the experience of practically all operators and by some this condition is not regarded as a complication (2).

In a majority of cases, perhaps, they may not cause any ill effects, but this is not true sufficiently often to make it unnecessary to be taken into consideration in determining the advisability of collapse therapy. It may interfere very greatly with an ultimate restoration of pulmonary function in the collapsed lung.

Even though there be no effusion, there will be obliteration of the pleural cavity with the reëxpansion of the lung. It has been said, as based on animal experimentation, that the gas introduced produces no irritating effect on the pleura. This may be true as regards the animals used in the experiments but it is certainly not true as regards man. I have never lost a gas pocket for any reason but that adhesions occurred, and never but once was I able to regain the pocket. In that case the patient had a reaction and an extensive exudate promptly resulted. The pleural space, however, may be restored.

Effusions and pleural adhesions are, it seems to me, the most common and most serious complications. Next to them come accidental pneumothorax. Personally I have had two cases of this, both due to tearing of adhesions, one by cough, one by refilling, the latter ending fatally. Theoretically it would seem that they should be more common than in pulmonary tuberculosis without induced pneumothorax because, in the latter, the chest wall acts as a buttress against the lung, protecting it against the sudden strain of coughing. Actually, however, it does not seem to be more frequent.

Other complications and dangers diminish progressively with the improvement of technique. Gas embolism I have not observed. Wood-

cock (5) says that "we therefore come to this, that the dangers of the operation have been sufficiently appreciated, but that the fear may have misguided the operator. This is unfortunate, for men have undoubtedly lost courage, death from gas embolism being a sinister event. To speak of such deaths as purely accidental is a descriptive inaccuracy, and it does not tend to courage in a practitioner when he fears his own hand." Rist (2) states that "we can repeat with Forlanini that cerebral embolism belongs to the historical period of pneumothorax."

Pleural shock has occurred in my practice but few times, and these of but little importance. Confirming the observation of Schwatt (22), I can state that I have not seen it in the last three years, since giving up the routine habit of administering a preliminary dose of morphine hypodermatically.

From the little attention now given to the so-called accidental complications, it must not be assumed that the practice of collapse therapy is a trivial matter. It is far from that. According to Amrein and Lichtenhahn (23), "the decision for the little (puncture) operation is taken too quickly and without forethought by the physician. . . . . We should like to say that it is very essential to have had a large amount of experience with the method of puncture both in producing and maintaining an artificial pneumothorax." The operator should be an experienced phthisiologist with a wide knowledge of the natural history of the disease. He should have acquired a competent judgment as to the indications and contraindications of the procedure and have a definite opinion as to its purpose in the case under consideration. He should have a thorough knowledge of the technique and especially of the interpretation of the manometric readings. He should likewise have an ability to interpret the Roentgenologic as well as the stethacoustic findings. Finally, his judgment as to the continuance of the treatment should be good.

Opinion as to the rapidity and amount of gas to be given and the amount of pressure to be obtained, especially in the first installation, varies within very wide limits. Murphy and Kreuscher (21) say that "the quantity of gas should always be large, that is, as much as the patient will tolerate without great dyspnoea. . . . . If compression is indicated at all, real compression is indicated, and 60, 150, or 200 cu. in. may be injected at a sitting if properly administered." Amrein and Lichtenhahn (23) report a case coming to them from another operator in whom 2000 cc. had been given the first time, followed

by 1000 cc. in a few days with a positive pressure of 16 cm. of water, with the statement that the greatest harm had been done. However, they give large quantities (1000–1200 cc.) early even if it produces shock and dyspnoea! Kendall (14) advises that "at the initial inflation it is well not to introduce more than 300 cc. of gas. This amount aspirated never distresses the patient." In the only directly fatal case in my own experience only 200 cc. of gas were given, with initial readings of −180, −60 and final readings of −50, +20 mm. actual water pressure. Dyspnoea occurred and the patient died in sixteen hours. Since that time I have been extremely careful not to give large quantities of gas at the first sitting except in hemorrhagic emergencies. I think it far safer to give a small quantity and repeat the procedure in a day or two, as indicated. "The temptation for the operator is always to give more than the ideal amount rather than less."

There is a constantly growing appreciation of the importance of the X-ray in this method of treatment. I would confirm the opinion I have already often expressed that no initial examination in a case of pulmonary tuberculosis is complete or competent without the use of the X-ray. It is, of course, possible to make a clinical diagnosis of pulmonary tuberculosis and a competent prognosis perhaps, but it is not possible to obtain an adequate knowledge of the pathology of the case. In the treatment by pneumothorax I regard it as even more essential. There is no other agent which will give us as accurate information as to the conditions and indications present after gas has been introduced. The size and distribution of the gas pocket, and the number, size, distribution and influence of adhesions cannot be even approximately determined by the ordinary methods of physical examination, but are revealed with great exactness by the fluoroscope and stereoscopic skiagraphs. Often the occurrence of exudate can be determined by them first. I need make only a very few quotations to support my views. "The X-ray apparatus is of the greatest importance . . . . it ought to be a rule not to operate without the control of the X-ray or in a house where there is not a fully equipped X-ray installation (23)." "The fluorosope and skiagraph are essential to a fair understanding of the changes that have taken place on the treated side and of the actual condition of the functionating lung (10)." Rist (2) says: "This assistance is indispensable; it is the *sine qua non* of any rational and methodical collapse therapy."

There is a general agreement that the duration of the treatment should

be "a long time" but what that long time means differs with different operators and in different cases with the same operator. This holds true of cases of the same designation as to stage of the affection. The determination of the period in any given case calls for the very nicest degree of judgment. We must bear in mind that "even the best conducted complete lung collapse does not 'heal' by the production of special immunizing bodies, but practically only mechanically. If the pneumothorax is abandoned within the first few years, the tuberculosis again resumes its course, since the 'disposition' to disease remains. A permanent immunity occurs only very slowly in the course of years" Kuhn (3).

When one reflects on how many breakdowns occur in other cases after arrest or "apparent cure" of many years standing, the advisability of prolonged treatment becomes evident and one is likely to agree that "the longer the better." On the other hand, he will recognize the ticklish position he is in when he remembers that the fibrosis extends beyond the affected tissues and the longer the treatment the more extensive the fibrosis.

SUMMARY

As the result of my own experience and a review of the literature I would make the following summary:

1. While the operation of induced pneumothorax *per se* is not a dangerous one, the practice of collapse therapy calls for special skill and judgment.
2. Collapse therapy unquestionably restores to practical health many otherwise hopeless cases, and prolongs the lives and increases the comfort of many others.
3. It is of positive influence in decreasing the period of incapacity.
4. It should be used in all cases of recurrent, severe and protracted hemorrhage.
5. It should be invoked, generally speaking, much earlier than is now the usual custom.
6. In justice to the patient it should be considered in every case of advanced or moderately advanced, slowly progressive pulmonary tuberculosis, and in every case of actively progressive pulmonary tuberculosis in any stage, because the natural trend of all these is toward death.
7. The constant tendency to diminution of the "gas pocket" by

pleural contraction following exudation should be persistently combated by frequent refillings under positive pressure.

8. Control by frequent skiagraphic and fluoroscopic examinations should be insisted upon whenever at all possible.

9. As Woodcock (5) well says: "There are dangers in connection with the production of artificial pneumothorax, but the greatest—and about this let there be no mistake—is the neglect in which it is held."

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DEDUCTIONS FROM FOUR AND ONE-HALF YEARS' USE OF ARTIFICIAL PNEUMOTHORAX IN THE TREATMENT OF PULMONARY TUBERCULOSIS[1]

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Forlanini's great contribution to phthisiotherapy excited at first but little interest in the United States despite Murphy's later development of the same idea (1896), and although Brauer in 1906, in Germany, adopted it enthusiastically, and was followed by Saugmann, Muralt, and many others, it was not until 1911 that the procedure began to find recognition in this country.

As early as 1908, I believe, Lapham began to try it out here, but artificial pneumothorax excited little general interest until the excellent article by Floyd and Robinson in the *Archives of Internal Medicine* in 1911, since which time it has been growing in popularity. To-day most of our phthisiotherapeutists are using it, much literature has come out on the subject, and whereas at first we had to borrow our ideas from the European literature, there is now a large enough body of American experience from which to draw conclusions as to its value and applicability.

Having begun to use it myself in December, 1912, and having applied it now in well over a hundred cases, I thought it might be worth while to look over my records and seek to draw such conclusions from them as seemed to be justified thereby. In speaking of this procedure, I have always avoided the term "operation," for it can scarcely be justly so called; moreover, the use of the term frightens patients and gives them a false impression of its severity, and hence I believe it is wiser to speak of it as a "method," or a "procedure." As to its danger and difficulty, while the first injection demands a great deal of skill, experience and judgment, reinjections, after a body of air has once been formed, are generally very simple procedures. Hence we are justified in presenting it to our patients as usually free from great danger. Its results

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cannot be judged by the same standard we would apply to many other medical or surgical measures, where we expect complete cures, for the majority of cases where it is used are advanced and indeed usually hopeless, and in dealing with such, where too often a real cure is out of the question, the physician, and the patient as well, are very well content to attain a marked amelioration of the symptoms and a more or less satisfactory prolongation of life rather than a real cure, and the percentage of real cures in such cases cannot ever be very large.

Looking over my cases I find records sufficiently full in a round one hundred cases. Being interested in curing my patients and not at all in demonstrating a high percentage of good results for pneumothorax, I have not hesitated to give every patient, however desperate his condition, the chance, if only the other lung was in fair enough shape and with sufficiently light involvement to anticipate that it could take up satisfactorily the work of the bad lung. Some might ask, "Would not the procedure have been even more useful in extremely incipient cases?" Unquestionably if I had picked out only incipient cases I could offer very brilliant results with a high percentage of cures, but since many years experience with tuberculosis has taught me what excellent results can be got in light, first stage cases by the careful use of our regular methods, I have felt no temptation to subject these patients to what is after all the relatively serious procedure of putting one lung entirely out of commission. Indeed, experience has shown that it is by no means always that a lung after compression will fully reëxpand, and it is only in exceptional circumstances that I have used it in early cases, and then only when they were dangerously active.

It is true that Murphy, when he advocated this method, which he worked out independently, even though he did not discover it first, advised its use particularly in early cases, but I feel very sure that had he been as expert a phthisiotherapeutist as he was a surgeon, and had he known by experience what could be accomplished in such cases by systematic treatment, he would not have so advised. Certainly I do not think that to-day physicians are at all justified in using pneumothorax in light, favorable, first stage cases.

This being my attitude, it will be realized that my cases are largely bad, advanced, third stage ones, in which a high percentage of good results could not be expected. Yet, bad as they were, I have been able to save the lives of some apparently utterly hopeless cases, have restored to working efficiency and good health 12 patients out of the hundred,

and in 20 others have prolonged life from a few months to as long as two years with great comfort and often with working efficiency.

Speaking to men who, like my auditors, are thoroughly familar with the treatment of this disease, and who know the difficulty of getting results in this class of cases, I am not afraid to state that 12 per cent of well and working patients and 20 per cent of prolongations and ameliorations, fully justify the original conclusions of Forlanini and point to artificial pneumothorax as a permanent and valuable addition to our therapeutic measures in this disease.

In studying my cases according to their state, I have to report 2 first stage patients in whom I considered the prognosis good. Further, I had 21 second stage patients of whom 4 seemed to justify good prognosis, 9 a fair prognosis, 8 a doubtful one. Of my 69 third stage cases, the prognosis seemed good in 2, fair in 3, doubtful in 17, bad in 30, and hopeless in 17; and yet let me here note that 2 of these latter, who seemed perfectly hopeless, (indeed the mother of one was weeping at what she supposed, and I did not doubt, was to be her son's deathbed) were restored to working efficiency and to the appearance of perfect health for two years. One only broke down again owing to his absolute neglect of himself and to unpardonable over-exertion, and the other through a poverty which compelled overwork. Further, in my bad third stage cases, in which it took a great deal of optimism to dare to hope for any results at all, I got two excellent working cures. Outside of these first, second and third stage cases, there were 7 acute cases and 1 case of simple abscess of the lung. Here let me note that my experience with these acute cases has led me to doubt whether they should ever be treated by pneumothorax. The idea of compressing a unilateral acute case, if such there be, or one that is partly unilateral, is naturally most attractive to the doctor, knowing so well that there is usually so little else that he can possibly do for such patients, and that only the mercy of God and rare good luck will in a few rare instances change their course to a chronic one with some possible chance of recovery. But in each of these cases no benefit of any sort was to be noted and their downward course was in no way arrested.

It would be foolish to draw any conclusions from one case of abscess of the lung cured, but in view of the difficult problem this condition presents to us, it is natural that physicians have believed that in carefully selected cases it offers us a brilliant opportunity. At the same time I would note that in another case of abscess of the lung in a tuberculous

person, I hastened an inevitable death by causing the abscess to break into the pleural cavity by gas pressure, thus forming an empyema, and if the abscess be superficial such a result is always possible.

Looking over the results in my hundred cases there are 11 in which *no entrance was possible*, in 9 of these owing to universal adhesions, while in 2 others, the procedure produced such extreme nervousness that I considered it unwise and impossible to persist.

Next, I would note 13 cases in which *the result was absolutely negative*, although in each instance I was able to find the pleural cavity, and in several of them continued injections for some time. In these cases the fever continued, the cough and expectoration were not affected, the toxaemia, which so usually disappears early, was uninfluenced, and in all of them I finally gave up interference. One of these was a second stage case of relatively good prognosis, although the pleural cavity was full of pus-forming bacilli. There was no fever, a good pulse and very few symptoms. I removed the pus and inserted gas, but not only did the pus re-collect, but there was no positive effects of any sort, and I gave up the effort. In two others, a young brother and sister of fifteen and seventeen, third stage cases of doubtful prognosis, with perhaps the poorest constitutions I have ever met, the gas was taken without any difficulty, but without any beneficial effects, and they went on to a rapid and fatal termination.

In another case the shortness of breath was so trying as to cause me to give up the procedure.

Forty-four out of the hundred patients I class as *failures*, these failures being due to various complications, but more than anything else to extensive adhesions, which, while not great enough to prevent entrance, either only enabled me to form pockets of gas here and there, or else developed long bands of adhesion, which bound the lung to the chest wall and allowed only partial collapse so that I could not stop the circulation of blood or lymph in the lung, on which the success of the procedure depends. In these 44 cases I found adhesions of one sort or another in 30. In a few instances I tried the recommended procedure of high pressure to break thin bands, and succeeded twice, but I consider it so dangerous, owing to the possibility of hemorrhage from blood vessels in the adhesive bands, that I have since given it up. In the last year a Swedish author has advised burning through the adhesions with an electrocautery, a measure which will certainly not be popular in this country. In some cases, of the number of which I have

no record, readhesion of the pleural surfaces occurred, although I was injecting gas at regular intervals. How this comes about I cannot say, but finally there were only pockets where there had at first been satisfactory gas space. In 7 of the 44, extension of the disease in the other lung occurred, which brought the procedure to an end, this being due in one or two of my earlier cases, I am sure, to the fact that I followed Brauer's advice as regards the amount of gas used, 800 to 1000 cc. at the first injection, and neglected Forlanini's much wiser advice to never exceed 100 to 300 cc. at first. In this way I placed too great a tax on the relatively healthy lung, and its increased function woke up the sleeping trouble. Two patients who had begun the gas elsewhere came here in a hopeless condition with empyema, and while at their request I continued injection of gas for a while, I was finally obliged to give it up. In this class also came the case I referred to, where I ruptured an abscess of the lung, and this, and one case of extension from too rapid collapse, are the only patients whose deaths were hastened by the procedure. Six of the failures were in cases of acute phthisis, 5 in young women; another such coming in the class where entrance was impossible.

Twenty-one of my cases show *excellent temporary success* with such amelioration of condition and prolongation of life as to fully justify the method, although in 11 it was unable to prevent an unfavorable termination. Three are still alive, 2 in very good shape, though in only one do I see any likelihood of recovery. Two I have already referred to as utterly hopeless cases to whom I was able to give two years of good working efficiency and thorough enjoyment of life. In another desperate case, while the improvement lasted only a month owing to extension in the better lung it was phenomenal, and had not extension occurred in the good lung by too large injections, I feel that she might have got many months more of very comfortable and happy life. One is still getting gas and doing well, but I do not feel sure enough of the outcome to class her as better than a "temporary success." Finally I have to report 12 successes. Of these, 2 have been lost sight of, but up to the time they were lost sight of they were both doing perfectly after long periods of collapse. One was a second stage case of great activity, in which I got the most perfect collapse I have ever seen, the lung being compressed into a small globular mass, projecting from the root about as large as a medium-sized peach, the patient having lost all symptoms.

The other was a case of simple abscess, to which I have referred. He was in a desperate condition, emaciated, with a terrible cough, high

fever, anorexia and profuse, purulent, offensive expectoration. Before I lost sight of him, he was restored to working efficiency without any symptoms. This patient during treatment suffered from marked dyspnoea, and at one time had a troublesome deep emphysema of the neck.

Two other cases have been brilliantly successful, but are still getting gas; one not because it is in any sense necessary, but because she refuses to allow the lung to reëxpand through nervousness over a possible bad result. She is living a normal family life, and has borne a healthy child. The other is a young man, doing perfectly in every way and fully able to work were it necessary for him. In his case I expect to stop gas shortly.

The last 7 are restored to full working efficiency, have lost their symptoms for from one to four years. One was a first stage case in which pneumothorax was practised after the removal of a pleuritic effusion, and which might doubtless have recovered in any case. One was a second stage case with good prognosis, in which gas was injected after the withdrawal of a massive effusion and in which there have been complete expansion with absolute clearing up of the lung and restoration to working efficiency, with the best strength and weight in his life.

Another second stage case, with fair prognosis, is now weighing more than ever in his life and is ruddy and strong, without symptoms and able to work.

Another third stage case, of fair prognosis, which had been collapsed elsewhere, showed no benefit until effusion occurred, and this seemed to help his symptoms. I removed fluid and substituted gas, but the fluid re-collected every time so that I finally left it in. He has worked since for three years without any further trouble and is in good health, although rather below weight.

Another doubtful third stage case was collapsed in my absence for hemorrhage by my associate, Dr. Ringer, who now has charge of him, and he is working every day. He told me the other day that he has no symptoms of any sort. Another third stage case, with bad prognosis, in a young woman, tending to dangerous rapid extension, showed the most happy results from collapse.

Finally, a young man, first collapsed four years ago on account of a bad third stage case, with dangerous extension, is doing office work every day, is in splendid health and fine nutrition, without any signs of trouble. This man had a long rest treatment without any results before pneumothorax was begun.

When I consider that 69 out of a 100 cases reported on were third stage cases, that 64 showed doubtful, bad, or hopeless prognoses, and that out of them I have got 12 per cent of good working results, I feel that I can be satisfied. Indeed, when I consider not merely these 12, but the 20 others with temporary success, and recall how much pleasure and happiness and usefulness were for a time restored to them; when I remember how gloomy and hopeless was their prospect, I feel that I owe a tribute of respect and honor to Professor Forlanini, whose great idea, put into practical application by its discoverer, was the cause of bringing to these hopeless people so much hope, and to the dying ones such prolongation of life. And even in those cases, when after temporary success, failure was the final result, who would not say that the pleasure they had and the prolongation of life they achieved, were not worth the while?

Complications and sequelae. These have been various and have been most instructive to me and my associate, Dr. Ringer, who has assisted me in all these cases, and who in my absence has renewed the gas in many of them.

The commonest complication is unquestionably the existence of adhesions, either universal, preventing entrance, or general so as to allow only the formation of multiple pockets, or localized so that they form bands preventing the complete collapse of the lung. I have records of adhesions in 47 of the cases reported, but I believe they existed in a greater number. In 3 of these cases adhesions formed again during the continuance of the injections, and finally necessitated their abandonment.

There is no really satisfactory method of determining whether adhesions exist, the X-ray and the regular methods of physical examination being only partially satisfactory. On the whole, I find normal percussion resonance to be the best guide as to the area in which it will be easiest to find free air space.

I regret that I did not keep full enough records to enable me to report on how many of my patients showed unilateral trouble and how many bilateral; but the percentage of the former was small, as is easy to realize when we consider how many are advanced, third stage cases, in which it is well known unilateral trouble does not exist.

My present practice is rarely to exceed 300 cc. at the first one or two injections, and to avoid very high manometric pressures; and since I have done so I have had much fewer extensions and trouble.

I have no record of how often I have had to withdraw gas to lower pressure, but I do not imagine it would amount to more than eight or ten times in my hundred cases.

The danger from adhesions is that it is often impossible, if they are close enough, to prevent the needle from going into the lung, and I have records of wounding the lung and causing blood spitting (fortunately without any bad effect) in six patients; even where there is an air space, it is perfectly possible to go through the pleura, not stopping in the pleural space, but going on into the lung. If the lung is purulent, as it was in one of my cases, on drawing the needle out again, you can infect the pleura and produce an empyema and get a fistulous tract. A far greater danger is that if the indications of the manometer (the application of which priceless instrument to this procedure we owe, I believe, to Muralt) are not closely followed and obeyed, it is perfectly possible to inject air into the lung itself; and while this is usually a harmless procedure, the air simply coming out of the mouth, if it chances that the needle enters a blood vessel, we may have fatal air embolism.

In one case, in my earlier practice, before I was thoroughly experienced, I several times, as I now realize, injected large amounts of gas into the lung and out of the patient's mouth without doing her any harm at all, but without the least benefit; whereas, had I thoroughly understood the indications of my manometer, this need not have occurred.

Up to my fifty-first case I kept a record of the collection of fluid, and found this complication in nine cases, but as some cases were not able to come to the office to be X-rayed, it is very possible that small amounts of fluid, though I trust not large ones, might have collected in a greater number; and from the statistics reported by other men I doubt not this was the case. The more careful we are in our examinations, the more we use the fluoroscope to control our work, the greater will be the percentage of cases in which we find fluid, but a slight trace of fluid in the pleural space, which does not increase, is of no clinical significance and can be negleced. Large collections of fluid are not very common. Of the nine cases I report, seven were large and two filled the pleural space up to the clavicle.

The question of the effect of a large effusion on the outlook of a case is to my mind as yet unsettled. The only real danger I can see is of the fluid becoming infected, either by the needle, after it has wounded an infected lung, or by a needle not sufficiently sterilized in the first instance.

In one very advanced hopeless case, with a pus-riddled lung, I am satisfied that I infected the fluid by wounding the lung and there resulted an empyema and a purulent tract leading to the surface, which, however, did not materially shorten an already doomed life.

In one case, in which I performed pneumothorax in a case of spontaneous pneumothorax to close a valvular opening, the effect was excellent. Further pumping of gas into the pleural space was stopped and for a year the patient did excellently. Finally fluid collected and nearly filled the chest cavity. This fluid slowly became purulent, necessitating the resection of a rib and causing the failure of the procedure. I have already referred to another case of empyema, where an abscess in the lung under pressure burst into the pleural cavity. The case was an almost moribund one, but I think that the empyema unquestionably hastened the fatal termination, and it is the only case that I have where the procedure brought about death.

With my present point of view, I prefer to leave fluid in the chest unless it produces symptoms, since in my experience it usually recurs after removal, and because on removing it I have seen troublesome readhesions follow, which prevented further compression. In a few cases I have seen its removal followed by the introduction of gas have satisfactory results. While doubtless pressure by fluid should be as effectual as pressure by gas, there is always a possibility of the fluid becoming purulent, so that I would regard the collection of fluid as an undesirable complication.

Emphysema of a slight degree has occurred in, I should say, about twenty-five of my cases, but I have kept no actual record of it. Aside from some temporary pain it has no significance of any sort. Deep emphysema in the deep fasciae of the neck with painful and anxious pressure symptoms I have met with twice, and while it passed off finally, it was so trying to the patient that I feel we should try to avoid it by not using too high intrathoracic pressure. It is naturally less apt to occur where we use smaller amounts of gas, but when there are pockets, pressure is apt to rise quickly, and it is in these cases that we most frequently get superficial emphysema, and where I fear it may occur I strap a pellet of cotton very tightly over the puncture opening.

A very troublesome complication, which in two cases was bad enough to force me to give up all attempts at introducing gas, is an extreme and uncontrollable nervousness, such as I have never seen in patients with ordinary thoracentesis, and which does not even yield to the preliminary

use of morphine, which is usually enough to prevent any undue nervousness in the average case. In these two cases nothing could control it and I feared that if persisted in the psychical and physical results might be serious.

The pain is not usually severe; indeed in the majority of cases we find the operation practically painless, if one uses a preliminary injection of adrenalin-novocaine, but in a few cases I have apparently touched the intercostal nerve while passing between the ribs, causing extremely severe pain, which, however, lasts only a short time. I find that this occurs much more often when I go in in the ninth space below the angle of the scapula, a popular location. For that reason I much prefer to go in laterally, outside the nipple and about in the anterior axillary line. This location makes entrance easier and less painful, and here we are less likely, I find, to meet bad adhesions.

When the lung collapsed is the left one, the diaphragm can be so displaced as to press considerably on the stomach, causing a troublesome dyspepsia. This occurred in four of my hundred cases.

An unusual complication in one case, was an apparently unduly thin non-resistant pleura. Its passage by the needle could not be felt, as it usually is, and gas would almost at once begin to hiss out around the needle through the puncture, even with low pressures. In this case I had to hunt around and find thickened patches of pleura to go through, which finally solved the difficulty and enabled me to collapse the lung.

The uncomfortable sensation of pressure produced by displaced mediastinum has troubled me in a few patients, and necessitated once or twice the reduction of pressure by removal of gas, but I have fortunately never met with rupture through into the goods side, though this has been reported in the literature.

Another interesting pleural condition which I met in one case, was a portion of the pleura calcified *en placque*, making it impenetrable by the needle. I was able to find other portions of the pleura which were not so calcified.

I have been surprised to meet so few cases of trying dyspnoea. I have had five such, and in only one did I have to remove gas to relieve it. With the use of small amounts of gas and low pressures I do not think it need ever be met, and it is now two years since I found anything of the sort, owing to my following of Forlanini's teaching in this matter. In a few cases high pressure is justified in an attempt to separate slight adhesions which prevent collapse of the lungs; but, as I have

said earlier, I have abandoned such attempts owing to fear of possible hemorrhage from broken adhesions, though twice it was successful in my hands.

While some authors speak of anorexia as frequently following this procedure, I have seen it but in four of my cases, and not to any trying degree. So many of these cases were bed patients that I have no record of weights, but I have not noted any undue tendency to loss of weight.

Our most serious complication save air embolism, is waking up of the process in the better lung. I have record of this occurring but three times, but I believe it has occurred oftener. When it occurs it is an indication, of course, for the removal of most of the gas and for advancing much more slowly, or giving up the procedure entirely. Great care in the study of the good lung before we begin, and from time to time, and the use of small amounts of gas slowly increased, is the best prophylactic measure, but I have found active blistering over the areas, where signs of waking up are beginning, to be of real use.

Fortunately I have met air embolism in but one case, and this case ended well. The patient, to whom I had given gas without any trouble a number of times, had that day received 200 cc. when he became deadly pale, purple splotches appeared on his chest, he became blind and could not speak, his pulse almost ceased, and he had an involuntary action. I removed the needle, stimulated actively, and he slowly rallied, and in an hour was very much better, though it took somewhat longer for satisfactory speech to return. After that I frequently gave him gas without any bad effects. The picture, however, of such a case was so alarming that I trust I shall never meet it again.

An unusual complication, and one that sounds very alarming, and certainly was so at the time, was in a young woman with an old fibroid lesion and extensive dense adhesions where the heart was displaced. I went in under the scapula in the ninth space, the patient gasped, turned deadly pale and blood under high pressure rushed up the needle and as far as the bottle. There was agonizing pain in the heart, which I had evidently punctured. I drew out the needle at once, kept the patient quiet and stimulated, and by the mercy of God rather than by my skill, she recovered with no bad effects, and to-day, one year later, is doing very well, but I cannot doubt that the needle entered the ventricle, as in that region there is no other place from which blood under such high pressure could be got. I did not repeat puncture in her case.

So much for the complications. As to the technique, I have but little to say. I have always used the Floyd-Robinson apparatus, made by Codman and Shurtleff of Boston, which I have found very satisfactory, although I consider the manometer very much too short, for it is very easy for the patient, should he cough while gas is going in, to blow all the water out of the manometer. The needle I have found excellent, and most satisfactory. While many careful men have used pneumothorax without the use of the X-ray, I feel that in these days it is practically an essential part of the outfit, and that fully satisfactory work cannot be done without this control. Certain of my patients being bedridden, it is not feasible to use it, but whenever it is at all possible, I control every case with it.

Too much importance cannot be laid upon a full understanding of the reading of the manometer. It is the only guide we have as to the proper location of the needle point, and our only protection against injecting air into a vein. Although it has been shown that ordinary filtered air can be used as well as nitrogen, I began with nitrogen at first, and having found it convenient, I continue to use it. While it takes some time for any one to get thoroughly familiar with the technique of a first injection, and this should not be turned over to inexperienced men, any intelligent doctor studying the literature on the subject carefully can very shortly master it, and should be able to avoid danger. While recognizing certain inherent dangers, I cannot consider it a dangerous procedure, though doubtless when I have been so unfortunate as to meet more bad complications, I will look upon it less favorably.

As would be expected, there were a much larger percentage of doubtful, bad, or hopeless cases in those patients in whom entrance failed, those in which results were negative, or where complete failure occurred, than in the others where temporary success, or working success, was achieved.

Of the "No Entrance" cases, 100 per cent were doubtful, bad or hopeless.

Of the "Negative" cases 22 per cent plus were good, or fair; 76 per cent plus were doubtful, bad, or hopeless.

Of the "Failures" 15 per cent plus were good, or fair; 84 per cent plus were doubtful, bad, or hopeless.

Of the "Temporary Successes" 25 per cent plus were good, or fair; 75 per cent plus were doubtful, bad or hopeless.

Of the "Successes Still Getting Gas" 33 per cent were good; 66 per cent were bad.

Of the "Working Successes" 56 per cent plus were good, or fair; 42 per cent plus were doubtful, or bad.

Doubtless had I selected incipient cases for collapse, I would have got a much higher percentage of successes, but as already noted, I do not feel this is legitimate in view of the fine results now obtained by regular methods.

It should be noted that among the "Temporary Successes" were several really wonderful results, with from one to two years of complete restoration, and that one of these had he been at all wise, would have certainly done well, but at the end of two years he, by his own folly, broke himself down. It seems to me that a procedure which applied to 69 per cent of third stage cases, 21 per cent second stage cases, and only 2 per cent of first stage cases, or, judging by prognosis, in which the prognosis was good in only 8 per cent, fair in 12 per cent, and doubtful in 25 per cent, bad in 30 per cent, hopeless in 17 per cent, acute in 7 per cent, or 89 per cent doubtful or worse, and which yet achieved 12 per cent of "Working Successes," and 20 per cent of "Temporary Successes," is certainly justified, and can be regarded as a permanent addition to the therapeutics of this disease.

Finally, it seems to me that the method is chiefly applicable to moderately advanced, or advanced, chronic cases, with or without acute exacerbations, but not to florid, acute cases, or to incipient ones, unless these show an acute waking up. It seems also that so far we have no definite guide as to the duration of the treatment, though after one year we should always consider the advisability of removing the gas and allowing the lung to reëxpand, for I am satisfied that many cases are kept collapsed too long.

Further, it may at times be useful in cases of abscess of the lung, and in hemorrhage, if we can be sure of the lung from which the blood comes, it is one of our most valuable measures, granted no adhesions exist. The procedure is unquestionably very dangerous if carried out carelessly, or without the constant use of the manometer, but in careful hands the percentage of danger should be very small, and while the chief danger arises while giving the preliminary injection, air embolism and other dangerous complications can occur during the course of reinjections.

Further, I am satisfied that Forlanini's advice that small amounts of gas be injected slowly and under low pressure should never be forgotten now in cases of hemorrhage.

TABLE 1

No entrance possible; eleven cases

	STAGE	PROGNOSIS	
Mr. T.....	Third	Bad	General adhesions, pain, nervous
Mrs. J.....	Second	Doubtful	Pain, extremely nervous
Mr. B.....	Acute	Hopeless	Nervous
Mr. C.....	Third	Bad	Adhesions
Mrs. V.....	Third	Bad	Adhesions
Miss H.....	Third	Hopeless	Adhesions
Mr. N.....	Third	Bad	Adhesions
Mr. H.....	Third	Hopeless	Adhesions
Mr. T.....	Third	Bad	Adhesions
Miss P.....	Third	Doubtful	Adhesions, punctured heart
Mr. M.....	Third	Hopeless	Adhesions

Summary

	NUMBER OF CASES	PER CENT
Doubtful	2	18.1
Bad	5	45.4
Hopeless	4	36.3
Total	11	100.0

TABLE 2

Negative effect; thirteen cases

	STAGE	PROGNOSIS	
Mr. F.....	Third	Hopeless	Adhesions, acute appendicitis
Mr. B.....	Second	Doubtful	Nervous
Miss S.....	Second	Good	For empyema. Tubercle bacilli bearing pus removed; no result
Mrs. B.....	Third	Doubtful	Nervous
Mr. L.....	Third	Bad	
Mr. P.....	Third	Doubtful	No resistance. Negative effect
Miss P.....	Third	Doubtful	No resistance. Negative effect
Mr. LL.....	Second	Fair	Temporary benefit, finally negative
Mr. T.....	Second	Doubtful	Absolutely no change
Mrs. W.....	Third	Hopeless	Amelioration for some time, finally negative
Mr. W.....	Third	Bad	
Mrs. R.....	Third	Bad	Dyspnoea
Mr. W.....	Second	Fair	

Summary

	NUMBER OF CASES	PER CENT
Good	1	7.6
Fair	2	15.3
Total	3	22.9
Doubtful	5	38.4
Bad	3	23
Hopeless	2	15.3
Total	10	76.7

TABLE 3

Failures; forty-four cases

	STAGE	PROGNOSIS	
Mr. G.	Third	Bad	Pockets only, other lung waked
Mrs. L.	Third	Hopeless	Adhesions, punctured lung
Mrs. W.	Third	Bad	
Mr. Y.	Third	Bad	Extension in other lung
Mr. W.	Third	Hopeless	Pockets
Mr. C.	Third	Doubtful	Pockets
Mrs. R.	Third	Hopeless	Adhesions, punctured lung, empyema and fistula
Mr. R.	Third	Bad	Pockets, extension in other lung, anorexia
Mr. McC.	Acute	Hopeless	Adhesions
Mr. T.	Second	Fair	Pockets, nervous, dyspepsia, anorexia
Mr. S.	Second	Fair	Extension in other lung, now well
Mr. H.	Third	Doubtful	Adhesions, pleurisy and effusion on other side, dyspepsia, dyspnoea
Mrs. C.	Acute	Hopeless	Extension, adhesions, pain, nervous
Miss R.	Second	Hopeless	Adhesions
Mrs. W.	Second	Doubtful	
Mrs. H.	Third	Bad	Adhesions, pain
Miss E.	Second	Fair	Pockets, nervous, pain
Mr. K.	Third	Bad	Pockets, dyspepsia
Mr. L.	Third	Bad	Pockets
Mr. M.	Acute	Bad	Pockets, pain, nervous
Mr. D.	Third	Doubtful	
Mr. W.	Third	Hopeless	Adhesions
Miss M.	Acute	Hopeless	Adhesions, nervous
Mr. L.	Third	Doubtful	Adhesions
Mr. M.	Third	Doubtful	Adhesions
Mr. T.	Third	Bad	Adhesions, calcified plate, air embolism, dyspnoea, nervous
Miss L.	Acute	Hopeless	Adhesions, deep empyema, pain, nervous, dyspepsia

TABLE 3—*Continued*

	STAGE	PROGNOSIS	
Mr. B.....	Third	Hopeless	Adhesions
Mrs. H.....	Second	Fair	Extension
Miss W.....	Third	Doubtful	Adhesions, nervous
Mrs. H.....	Third	Doubtful	Pockets, extension
Miss G.....	Third	Doubtful	Pockets
Mr. P.....	Third	Fair	Adhesions, central consolidation
Mr. G.....	Third	Bad	Pockets
Mr. P.....	Third	Bad	Adhesions
Mr. P.....	Third	Bad	
Mr. P.....	Third	Hopeless	Empyema (begun elsewhere)
Mr. M.....	Third	Hopeless	Empyema (begun elsewhere)
Mrs. W.....	Third	Hopeless	Adhesions, pain, nervous
Mr. C.....	Third	Good	Nervous, continued elsewhere
Mrs. B.....	Third	Bad	Adhesions, now well
Mr. E.....	Third	Good	For haemorrhage, fluid
Mr. W.....	Third	Bad	Extension
Mr. B.....	Third	Hopeless	Abscess burst, empyema

Summary

	NUMBER OF CASES	PER CENT
Good	2	4.5
Fair	5	11.3
Total	7	15.8
Doubtful	9	20.4
Bad	14	31.8
Hopeless	14	31.8
Total	37	84.

TABLE 4

Temporary successes; twenty cases

	STAGE	PROGNOSIS	
Miss P.....	Third	Doubtful	Adhesion bands, given for hemorrhage
Mrs. C.....	Third	Doubtful	Fluid
Mr. W.....	Third	Fair	Great success, then fluid and dyspepsia, emphysema
Miss S.....	Third	Hopeless	Wonderful improvement, then extension, place leaky
Dr. G.....	Third	Doubtful	
Miss E.....	Second	Fair	Good gains, went elsewhere
Mr. P.....	Third	Bad	Great gains, adhesions, nervous
Mr. H.....	Second	Fair	Fluid, continued elsewhere
Mrs. F.....	Third	Doubtful	Great gains, then readhesion
Mr. B.....	Third	Bad	Great gains, went elsewhere
Miss W.....	Third	Bad	Great gains, readhesion
Miss M.....	Second	Doubtful	Great gains for one year, then readhesion
Mrs. H.....	Third	Bad	Great gains, fluid, adhesions
Mr. F.....	Third	Bad	Gains, went elsewhere
Mr. G.....	Third	Hopeless	Marvelous gains, for two years at work, then fluid
Mr. A.....	First	Good	Gains, went elsewhere
Mr. B.....	Third	Hopeless	Marvelous gains, two years work, imprudence, accident
Miss H.....	Second	Doubtful	Some gains, then spontaneous pneumothorax (Dr. Ringer)
Mrs. G.....	Third	Bad	Slight gains, then adhesions
Mr. E.....	Second	Good	For spontaneous pneumothorax, fluid, empyema

Summary

	NUMBER OF CASES	PER CENT
Good	2	10
Fair	3	15
Total	5	25
Doubtful	6	30
Bad	6	30
Hopeless	3	15
Total	15	75

TABLE 5

Success still getting gas; three cases

	STAGE	PROGNOSIS	
Mrs. P.....	Third	Bad	Marked gains
Mr. A.....	Second	Good	Doing splendidly, fit for work
Miss H.....	Third	Bad	Married, has a child, doing very well

Summary

	NUMBER OF CASES	PER CENT
Good	1	35
Bad	2	66
Total	3	100

TABLE 6

Success, lost sight of; two cases

	STAGE	PROGNOSIS	
Mr. S.	Abscess	Fair	Dyspnoea, empyema, restored to work
Mrs. C.	Second	Doubtful	Perfect collapse, lost all symptoms

Summary

	NUMBER OF CASES	PER CENT
Fair	1	50
Doubtful	1	50
Total	2	100

TABLE 7

Working successes; seven cases

	STAGE	PROGNOSIS	
Mr. M.	Second	Fair	Perfect shape, at work
Mr. F.	Second	Good	After paracentesis, full reëxpansion
Miss W.	Second	Doubtful	Fair progress, no symptoms
Mr. O.	First	Good	After paracentesis
Mr. B.	Third	Bad	Wonderful success, at work four years, fluid
Mr. McC.	Third	Good	Collapsed elsewhere, fluid left in
Mr. C.	Third	Doubtful	For hemorrhage, at work two years

Summary

	NUMBER OF CASES	PER CENT
Good	3	42.6
Fair	1	14.2
Doubtful	2	28.4
Bad	1	14.2

SPONTANEOUS PNEUMOTHORAX DURING THE COURSE OF INDUCED PNEUMOTHORAX

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To one familiar with the pneumo-mechanics of the chest, it seems that spontaneous pneumothorax during the course of an induced pneumothorax should be a rather frequent complication. The literature, however, shows rather few reports despite the large number of cases induced during the past fifteen years. That it may have been overlooked, or the symptoms ascribed to other complications are probable reasons for the infrequent reports. Sachs (1), in reviewing the work done on artificial pneumothorax in America up to 1915, could find only 10 cases of spontaneous pneumothorax developing in 1145 cases induced.

Beggs, in discussing induced pneumothorax before the Denver County Medical Society in 1914, mentioned his surprise at the infrequency of this complication. He stated that the reason he thought that spontaneous pneumothorax during the course of induced pneumothorax should be more frequent was that when gas was interposed beween the chest wall and the lung, the support naturally given to the lung during cough and strain was gone. Instead there is a flexible body (gas). If any weak spots are present, it is rather reasonable to expect that these weak spots will give way during strain when their firm support is gone. Close study of most of the reports as well as the study of our cases makes us believe in Beggs's theory as to the cause of most of these. The majority of spontaneous pneumothoraces complicating induced pneumothorax occurred a number of hours after the last injections and after low pressures, as a rule. Not all of the cases, however, can be classed as having been produced in this way. Some might have been caused by the tearing of adhesions; others by actual damage to lung tissue as in Walgren's (2) case, in three cases reported by Webb (3), wherein the spontaneous occurred within twenty-four hours after the first injection; and in 2 cases described by Harris (4). Besides these, Krause (5) described 2 cases wherein he suggests that the cause seems to have been the giving way of a weak spot adjacent to a tightly stretched adhesion.

The symptom complex seems to be rather constant and the occurrence of the sympton complex during the course of an induced pneumothorax should put one on his guard. There is invariably pain on the collapsed side, with marked dyspnea and a sudden rise in temperature, which might be increased from normal to 102° F., or even 104° F. within a few hours. Given this complex during the apparently normal course of an induced pneumothorax, one should immediately try to either prove or disprove the occurrence of spontaneous pneumothorax. Of course, physical examination will prove of some help, but the most important procedure we have found to be the introduction of the pneumothorax needle. When the needle is introduced into the pleural sac and the manometer opened, there is usually a rather high positive present, even up to + 40, + 90 mm. of water. This will be present even though the last reading on the previous injection was zero or negative.

We were induced to report our cases because of the paucity of the literature on this subject. Hornung (6), in 1913, reported 2 cases. The first became extremely dyspneic and cyanotic with severe pain on the side of pneumothorax: "the patient felt something tear." The temperature is not mentioned here. These symptoms came on three days after the third injection of 300 cc. of gas, and the death resulted in seven hours after the onset. The second case developed marked dyspnea with cyanosis and extreme pain four days after the third injection of 600 cc. at a final pressure of 0, + 3 cm. of water. The temperature jumped to 40.2° C. The manometric reading showed + 15 cm. of water. The patient was treated by withdrawal of gas and recovered. He also mentions the fact that Forlanini had reported 8 such cases. Aside from these 10 cases and the 10 cases reported by Sachs in 1915, which include the cases of Webb and Harris, the only others we could find are 1 case reported by Wallgren, 3 cases occurring late in induced pneumothorax reported by Krause, and 1 case by Giese (7), making a total of 25 cases.

Through the kindness of Wm. N. Beggs of Denver, we are able to add 2 cases that occurred in his practice. These cases, with 4 of our own, make to total of 31 cases to date. The following cases are those of Beggs:

Mrs. L. F. G., pneumothorax induced November 5, 1913. On March 1, 1914, one day after the fifteenth injection of 600 cc. of gas to a pressure of +25, +35 mm. of water, following a severe coughing spell, she developed pain on the side of the pneumothorax with marked dyspnea and temperature to 102.2°F. Within the next two days the temperature rose to 104°F., and

remained high for three weeks. No manometric readings were taken at this time. Fluid developed by March 12. The patient was treated by withdrawal of fluid and replacement by gas. She is still taking pneumothorax and feels perfectly well.

L. C. B., pneumothorax induced August 27, 1916. On September 15, one day after the fifth injection of 1100 cc. with final reading of −25, +15 mm., the patient developed pain on side of pneumothorax with marked and increasing dyspnea, and increased temperature. Was treated by withdrawal of gas with good results. The readings are interesting enough to note:

September 20. 450 cc. withdrawn: 0, + 30 to −25, +15.
September 30. 400 cc. withdrawn: +55, +110 to −15, +25.
October 10. 500 cc. withdrawn: +60, +175 to −10, +20.

The cases described below were seen by us since January 1916:

M. S., pneumothorax induced in November, 1915. January 15, 1916, at 8 a.m., three days following his twelfth injection of 500 cc. with final reading of −20, +10, he developed severe pain on the side of the pneumothorax. Twelve hours later he became markedly dyspneic, with temperature to 104°F., and excruciating pain on the side of the pneumothorax. Manometric reading showed +30, +90 mm. Treated by withdrawal of gas. The patient left the sanatorium on February 15, walking to the car line.

J. S., pneumothorax induced for hemorrhage, April 13, 1916. April 26, two days after the fifth injection of 700 cc. to final pressure of −12, +12 mm., he developed pain on the side of the pneumothorax, with dyspnea and cyanosis and temperature to 103.4°F. Manometric reading, −50, +45. We withdrew gas a number of times during the day, reducing the pressure to −65.0 mm. The patient died same night of pulmonary edema in the opposite lung.

J. T., pneumothorax induced May 25, 1916, for fever and cough and occasional hemoptysis. On June 21, one day after the fourth injection of 450 cc. to final pressure of −45, +8 mm., he developed sudden pain on the side of the pneumothorax with marked dyspnea and cyanosis and temperature of 103°F. Manometer reading showed +5, +30 mm. Roentgenogram, June 3, showed complete pneumothorax on right side. Treated by withdrawal of gas. Temperature normal on June 26; pneumothorax continued. He later developed sero-pneumothorax, diagnosed on July 10, 1916. This became purulent late in November, and the patient died of hemorrhage from a duodenal ulcer (proved by autopsy) on December 25, 1916.

L. B., pneumothorax induced September 9, 1916 for fever and rapid advance of lesion in right lung. On September 29, 1916, one day after the ninth injection of 500 cc. to final pressure of −20, +20 mm., he developed pain on the right side with marked dyspnea and rise of temperature to 105° F.

Manometer reading, −20, +40 mm. Treated by withdrawal of gas. Temperature normal on October 6. Pneumothorax continued. Sero-pneumothorax diagnosed on October 11, 1916; became purulent December 2, 1916. Treated by aspiration and replacement with air. Doing fairly well at present.

We should like to call attention to two main thoughts brought out by our study of this complication; first, the symptom complex: sharp pain on the side of the pneumothorax, dyspnea and sudden rise of temperature; and second, the treatment which seems most plausible is to relieve the pressure by aspiration as often as it seems necessary, but allowing sufficient gas to remain to keep the lung collapsed without embarrassing the patient, providing the opposite side still seems able to do the necessary work and shows no evidence of breaking down. The question of prevention is an open one. As far as we can see it seems impossible from our present knowledge to know when to expect the development of a spontaneous pneumothorax during the course of an induced pneumothorax.

We should like to take the opportunity here of thanking Drs. Wm. N. Beggs, A. S. Taussig, and Emanuel Friedman for their advice and aid in handling our cases and preparing this report.

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THE WASSERMANN AND LUETIN REACTIONS IN TUBERCULOSIS

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The average tuberculosis sanatorium on account of its size cannot afford to have a trained serologist or laboratory man who can do its Wassermann tests. These tests also require a certain amount of equipment which the average institution does not possess. Of course the sera can be sent to the nearest health laboratory, but this entails certain procedures which in the majority of cases prevent using this test as a routine measure. The Noguchi luetin test, on the other hand, is simple of performance, requires only such training as the average tuberculosis physician has had, can be done quickly without the consumption of too much time and requires practically no equipment. It was with a view of determining the value of the luetin test, whether it is of any specific value, whether it can be used to displace the Wassermann test in tuberculosis sanatoria, or whether both tests have their place, the Wassermann revealing early cases and the luetin the tertiary or latent disease that the investigations to be reported in this paper were carried out.

It is unnecessary to say a great deal about the value of the Wassermann reaction. Its value as a diagnostic agent, when properly done and carried out with standard reagents, is practically beyond great criticism as is attested to by the recent excellent investigations of Snow and Cooper (1). They used the standard and a number of cholesterinized antigens and conclude as a result of their work that:

1. The percentage of non-syphilitic, tuberculous patients whose blood may bind complement with non-cholesterinized antigens is so small as to be practically negligible. Complete complement fixation, that is, a strong, $++$, Wassermann reaction with non-cholesterinized antigen, in a tuberculous patient, is as adequate presumptive evidence of syphilis as it is in a non-tuberculous individual.

2. The sera of non-syphilitic tuberculous patients may give partial, $\pm$, to complete, $++$, complement fixation with cholesterinized antigen in about 31 per cent of the cases. In a general way the recent work of

Graves (2) in studies upon post mortem Wassermann reactions reveals the high efficiency of this test, the sera of 90.4 per cent of cases showing post mortem anatomic lesions or presenting positive evidence of syphilis in their histories giving positive Wassermann reactions.

On the other hand the luetin test has been open to severe criticism and requires, to say the least, the utmost caution in performance, being markedly influenced by certain drugs administered while making the test according to observations reported during the past year. Stokes (3) believes the luetin reaction ought, like the reaction to agar, to be placed, in large part at least, in the class of antiferment adsorbent or anaphylatoxin reactions, treating it as in the case of the reaction to agar, not as specific for syphilis, but as a measure of the ferment-antiferment balance and of the amount or intensity of action of non-specific proteases in the body of the syphilitic. In 1915 Sherrick (4) noted the fact for the first time that the administration of potassium iodide will cause a positive luetin reaction in 99 per cent of all cases tested, irrespective of the presence of syphilis. Other substances, such as agar and starch, when injected intradermally, will give a similar reaction when potassium iodide is administered. Other drugs containing iodin have a similar influence on the luetin reaction. Kolmer, Matsunami and Broadwell (5) repeated these observations with Noguchi's luetin and found that positive reactions among normal non-syphilitic persons could be obtained as late as one month after the ingestion of large doses of potassium iodide. Kolmer, Immerman, Matsunami and Montgomery (6) found bromides of potassium and sodium in doses of 60 or more grains to have a similar but less marked influence. Even the chlorides of potassium and ammonium had a very slight influence.

The series of cases (a total of 198) to be reported on in this paper were all patients of a tuberculosis sanitarium, which accounts for the lack of normal control cases in the series. Every patient had at least one Wassermann test performed on him, and in the majority of cases two or three such tests. The Noguchi anti-human hemolytic system and simple non-cholesterinized beef heart antigen were used for the tests. The luetin was obtained from Parke, Davis and Company[1] and was used in amounts of 0.05 cc. for each injection intracutaneously. The luetin reactions were observed and classified according to Noguchi's (7)

[1] We wish to express our appreciation to Drs. W. E. King and F. W. Baeslack of the Parke, Davis and Company for supplying the luetin freshly prepared, which was used in these tests.

original observations, but in tabulating only papular-pustular or pustular reactions were called positive. Observations were extended in the majority of the negative cases to about a month to avoid missing torpid forms. The cases tabulated were classified according to the National Association classification into non-tuberculous, questionably tuberculous, incipient, moderately advanced and far advanced. A separation into active and inactive cases was also made, but this revealed nothing of special interest.

Luetin tests in tuberculosis patients with negative and positive Wassermann reactions

CLASSIFICATION	WASSERMANN REACTION NEGATIVE		WASSERMANN REACTION POSITIVE	
	Luetin —	Luetin +	Luetin —	Luetin +
Non-tuberculous	0	0	1	2
Questionably tuberculous	10	10	1	3
Incipient	18	9	0	2
Moderately advanced	33	21	2	5
Far advanced	30	39	6	6
Total	91	79	10	18

A glance at the table reveals the results of the luetin findings in the negative and positive Wassermann cases of tuberculosis: 79 of a total of 170 negative Wassermann cases gave a positive luetin reaction, while only 18 out of a total of 28 positive Wassermann cases gave a positive reaction. As a whole these observations seem to justify the following conclusions:

1. The luetin reaction cannot be used as a test for lues in a tuberculosis sanitarium to displace the Wassermann test.
2. The luetin reaction in tuberculosis patients with a negative Wassermann gives a high percentage of positive results (47 per cent).
3. On account of this high percentage of reactions not due to tertiary or latent syphilis in tuberculosis patients, the luetin reaction as carried out today with the luetin obtainable on the market is unreliable.

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THE RELATION OF FISTULA IN ANO TO TUBERCLE INFECTION

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The publication of a paper on the relationship of infection with the tubercle bacillus and the lesion of fistula in ano would seem almost to need an explanation, so frequently has this subject been discussed before. The importance of the issue is such that there would be ample reason for the publication, were it possible to bring forward a conclusive answer to the problem. Lacking this, however, one may still find sufficient justification in the fact that discussion still exists and uniformity of opinion is absent. The purpose of this paper is to review certain of the expressions previously published, to sift the evidence and to weigh the judgment already presented in the literature, and to add certain new data of my own; in short to offer a critical resumé of an unsettled question.

The literature already accumulated on this subject is so extensive as to make desirable a selective rather than an exhaustive review. Hence, not every paper that has dealt with the question will be considered or even referred to. Rather, an effort will be made to present characteristic and important opinion at the present time, with a brief sketch of its development.

In approaching a disputed question, it is not a bad plan to determine precisely what points are generally agreed on and what are not. This one may easily do as regards the relationship of fistula to tuberculosis. To proceed logically, one may ask the following questions:

1. Is any fistula definitely and specifically a tuberculous lesion?
2. Is any fistula definitely and specifically not a tuberculous lesion?
3. If both of these questions be answered in the affirmative, what proportion of fistula cases is definitely tuberculous?
4. What proportion of fistula cases is probably, but not definitely tuberculous, and on what data is this determination made?

The first and second of these questions may safely be answered affirmatively. If proof were needed, it is furnished by such illustrative cases as these drawn from my own experience.

Case 1. Tuberculous fistula. W. B., Johns Hopkins Hospital Dispensary. No. F-69629. Colored, male, age 48 years. Weak, emaciated. Extensive, active pulmonary tuberculosis. Fistula of about eighteen months' standing. Fistula excised under local anesthesia. Tissue removed. Was reported as typically tuberculous on histological study. Wound was unhealed when last seen.

Case 2. Non-tuberculous fistula. G. W. H., private case. White, male, age 64 years. Swallowed piece of bone in thick soup. Two days later, sharp pain in anal region. A large perirectal abscess rapidly developed and was opened by the family physician, who recovered the fragment of bone. Examination for fistula one month later showed no evidence of tuberculosis, locally or in the lungs. Fistula excised. Tissues showed no evidence of tuberculosis on microscopic examination. Wound healed promptly.

These cases are so clear in their contrast that comment seems scarcely necessary. One may say that some fistulae are surely tuberculous and others quite as surely have no relation whatever to infection with the tubercle bacillus. This much will probably be admitted by all. It is when one attempts to estimate the proportion of all fistulae that are tuberculous, that radical difference of opinion develops. To certain of these opinions attention will now be directed.

Melchior (1) in 1910 published a series of 197 cases from Kuettner's clinic in Breslau, with a review of the literature up to that date. His article supplies an extensive bibliography of the subject, and many of the opinions here quoted are selected from his references, in most cases being verified by the present writer. Melchior is a strong proponent of the view that there is a very intimate connection between tuberculosis and fistula, presenting practically all the evidence obtainable at the time of writing that bears on the subject. In brief, he concludes from the study of his own series of cases that at least 61 per cent of fistulae are tuberculous. In support of this position, he adduces the following facts:

Of the total number of cases (197) treated between 1892 and 1909, Melchior was able to follow up successfully 132. Of these 46 (more than one third) died during the period under consideration. Of the 46 deaths, 32 were due directly to tuberculosis. Three other deaths, not directly due to tuberculosis, were largely contributed to by active infection with the tubercle bacillus. Therefore, 35 cases (76 per cent) among the 46 dead were tuberculous. V. Kozuchowski's (2) statistics show almost the same result. Of the living cases in Melchior's report,

40 showed no demonstrable tuberculosis. In 37 cases there was at some time the observation of a demonstrable tuberculosis. In nine cases there was a suspicion of tuberculosis. If one adds these nine cases to those in which a definite diagnosis could be made and compares the total number of the tuberculous, including the dead, with the definitely non-tuberculous cases, they are as 81 : 51, that is to say, the tuberculous are 61 per cent of the total. Most of the tuberculous cases were of the pulmonary type of infection. A few were also intestinal. Melchior points out also that one must not calculate the frequency of tuberculous cases unless their after history is carefully followed up, since, in a not inconsiderable number of instances, the cases that were clear at the time of operation later present evidence of tuberculosis. If some consider that 61 per cent is an excessively high proportion of tuberculous cases, Melchior is forced to regard it as the minimum; for, he reasons, many cases which show no lung signs have local appearances at the fistula, suggestive of tuberculosis, such as the appearance of the granulation tissue or the skin edges. Also cases that die of intercurrent disease or accident soon after operation should not be counted in the statistics as non-tuberculous, since the later history of some such cases might show a different story.

Melchior believes that the local appearances of the fistula are of great diagnostic importance in those cases where no other signs of tuberculosis can be made out. In his opinion a tuft of granulation protruding from the external orifice of the fistula definitely suggests tuberculosis. Absence of such condition is not definite evidence against tuberculosis.

In ten cases in which tissue was examined microscopically, Melchior found that one was due to a foreign body. Five were tuberculous and four were negative. Of the four negative cases, however, two died later (one after four years and one after eight years) of tuberculosis. In one of the other negative cases, pulmonary tuberculosis was present at the time of operation. The fourth case showed no evidence whatever of tuberculosis in any way, either at the time of operation or when followed up six months later. From this Melchior concludes that negative microscopic findings are not conclusive evidence against the presence of tuberculosis. Of the five cases that showed histological tuberculosis, four showed no lung involvement. Without the tissue examinations one would, therefore, have classed these as negative cases. From these facts Melchior concludes that 61 per cent represents the minimum proportion of cases which must be regarded as due to tuberculosis.

Melchior is not alone in his opinion that there is a very frequent relationship between fistula and tuberculosis. Thus Volkmann (3) at the Surgical Congress in 1885 said:

> A portion of fistulae has from the beginning the nature of tuberculous ulcers. The insistence of the older surgeons on the relationship of fistula and pulmonary tuberculosis becomes clear from this fact, or rather is corrected by it. Tuberculous fistula is distinguished from the non-specific one by the tendency to the formation of great masses of fungus granulations, in extensive dissection of the mucosa and skin, and sinuous tracts.

Hartman and Lieffring (4) found tubercle bacilli in seven out of twelve perirectal abscesses by animal inoculations, and, of course, the importance of such abscesses in the causation of fistula is well known. Francou (5) reports two positive cases of animal inoculation from fistulae. Schuchardt (6) reports one fistula case with histological demonstration of tuberculosis. Liebrecht (7) reports a case in which typical lupus developed in the scar after an operation for fistula. Besnier (8), quoted by Hartman, reports a similar case and Melchior, mentioned above, had another one. Quénu and Hartman (9) report the microscopic examination of six fistulae excised from tuberculous patients. Only four of these showed tubercles under the microscope. The other two were negative.

Arnold (10) states that the most important of the factors causing fistulae other than simple pyogenic infection is tuberculosis, but gives no estimate of the actual frequency of this particular form of infection. He gives a review of the bibliography, however, and points out that Jean Louis Petit first observed that fistula and pulmonary tuberculosis frequently occurred together. He quotes Louis as regarding this relationship between pulmonary tuberculosis and fistula as an error. Clark, Schoenerlin, and Pereira, on the other hand, are mentioned as believing in a high coincidence between pulmonary tuberculosis and fistula. Greffrath is quoted as thinking that 10 to 14 per cent of all fistula cases have tuberculosis of the lungs; Rotter as saying that 5 per cent of all patients with pulmonary tuberculosis have fistula; Hartman, that 50 per cent of all fistula cases are tuberculous. Arnold further gives the experience of Meyer who found that in his medical wards among 460 tuberculous patients, there were only 0.87 per cent with fistula, whereas on the surgical wards out of 139 fistulae cases 9.3 per cent had tuberculosis. Mitchner (11) states that in those cases where complete and

severe multiple fistulae exist, there is nearly always a condition of abdominal or pulmonary tuberculosis, suggesting that the fistulae are tuberculous in origin. Koenig (12) designates tuberculous fistulae as infinitely more numerous than others. Rotter (13) considers tuberculosis as of great weight in the etiology of fistula without giving any facts for his opinion. Wunderlich (14) particularly emphasizes how frequently periproctitic abscesses that usually result in fistulae occur in tuberculous subjects.

A number of men who have written on the subject have mentioned incidently that tuberculosis is considered an important cause of fistula. Most of the standard text books on rectal diseases take this attitude without specifying the facts upon which the statement is based. Thus Pennington (15) says, "from research that has been made it seems that the bacteria most frequently causing abscesses in connection with the rectum and anus are the tubercle bacillus, bacillus coli, staphylococcus and streptococcus," and Saphir (16) mentions tuberculosis incidently.

In the papers published within the last six or seven years one finds a general trend toward skepticism concerning the importance of tuberculosis in relation to fistula. Thus Elting (17) expresses the opinion that:

> Tuberculosis plays a comparatively insignificant rôle in the causation of this condition. The relatively high percentage of tuberculous fistulae in ano given by some writers is undoubtedly based upon a clinical rather than a bacteriological or histological diagnosis. The more that careful laboratory methods are employed in the study of fistulae, the smaller the tuberculous percentage grows. Furthermore, in the majority of the tuberculous cases the condition is usually secondary to some other demonstrable tuberculous lesion elsewhere in the body, rather than the primary focus.

In 105 cases operated upon, careful histological examination of the tissue removed was made at the Bender Hygienic Laboratory. Of this number 96 were found to be histologically non-tuberculous, and nine histologically tuberculous. Of the nine tuberculous cases seven had demonstrable pulmonary tuberculosis at the time of operation. He reaches the conclusion that probably not more than 10 per cent of the fistulae in ano are tuberculous and a great majority of these are secondary to demonstrable tuberculosis elsewhere in the body, usually in the lungs. Back (18) believes that with increasing experience one is lead to the conclusion that the percentage of cases of genuinely tuberculous origin

is much smaller than is commonly thought. "I do not believe that the tubercle bacillus is responsible for more than five per cent of all cases." Lexer (19) says, "Fistulae in ano have from early times been considered generally tuberculous, frequently incorrectly." V. Kozuchowski (2), quoted by Melchior above as finding approximately the same percentage of fistula cases with pulmonary tuberculosis as he himself reports, nevertheless believes that pulmonary phthisis is of no particular importance in the etiology of fistula. Allingham (20) finds that of 1632 fistulae cases 234, or 14 per cent, present manifest pulmonary tuberculosis. Evans (21) states that "about 6 per cent of people who have phthisis also have fistula, and a larger per cent of the people who suffer from fistulae have lung trouble. There are two varieties of tuberculous fistulae: one a local deposit of tubercle bacilli in the rectum which terminates in fistula; the other a simple fistula in a very run down person as a result of a long standing lung trouble. In the latter no bacilli can be found in scrapings from the fistula."

The most vigorous and best sustained argument against the tuberculosis idea that has been reviewed is that presented by Frey (22), based on the material of the private clinic of Krecke at Munich comprising 72 cases. Frey assails the conception that infection with the tubercle bacillus is to be considered a most important factor in the development of fistula. After a brief review of the opinions of older writers, many of which have already been quoted in this paper, he presents his own evidence. In only five of his cases could a tuberculous connection be determined by either macroscopic or microscopic examinations. In none of the other cases could any specific change in the tissues be made out. Thus, opposed to Melchior, his percentage of tuberculous cases is only 6.9 per cent. Frey then goes into a discussion of the factors that lead to this discrepancy in percentages. After pointing out certain differences in the clinical material at Breslau and at Munich, he calls attention to the fact that Melchior classes as tuberculous fistulae those cases in which the fistulae may show no specific change even under the microscope, but in which the patient has positive lung findings, or even becomes tuberculous or dies of tuberculosis within a few years after operation. He further calls attention to the fact that among Melchior's 197 cases only thirty-seven were tuberculous and nine suspicious at the time of operation. But, again, these figures are much greater than his since he found that at the time of operation only three were phthisical and two suspicious, while no case

later developed tuberculosis. He attacks the assumption that a fistula is tuberculous merely because its bearer later suffers from tuberculosis elsewhere in his body. He states that tuberculosis is such a common disease that surely it may attack persons having fistula, whose fistula otherwise has no relation to the tubercle bacillus, and concludes by stating that in his opinion the diagnosis of tuberculous fistulae must be based exclusively on the findings in the fistula itself, and on this he must regard tuberculosis as playing a relatively small rôle in the etiology of fistula.

The present writer, within the last three years, has seen in the Rectal Department of the Surgical Dispensary of the Johns Hopkins Hospital and in private practice 123 cases of fistulae. Unfortunately of that number only 31 were subjected to a careful scrutiny for evidences of tuberculosis elsewhere in the body. The others received only a routine examination which might easily have missed inactive or slight lesions. Of the 31 cases thus examined 9 were entirely negative as to physical condition, history, X-ray of chest and local appearance of lesion. Among the others, 3 were under treatment at the time in sanatoria for active pulmonary lesion; 2 had been previously in sanatoria for pulmonary lesions; 1 developed an active lesion three months after operation; 7, on careful examination, showed evidences of chronic inactive tuberculosis of the lungs, and 7 acute active tuberculosis for which they were not receiving treatment at the time of operation. Besides there were two infants, one of whom had slight glandular enlargement in the neck and another in the groin, but presented no other evidence that could be considered in any way tuberculous. From this short series of cases it will be seen that, assuming the two infants to be negative, which from the nature of the cases seems a fair assumption, eleven of our series, or more than one third, could not in any way be connected with infection by the tubercle bacillus. Of the other, seven were found on very careful examination to show evidences of a previous involvement of the lungs. It is fair to state that an examination as rigid as this one of 31 cases, selected at random from any group of patients, would probably show nearly as great a proportion of people who had at one time suffered with a pulmonary lesion. There remains the indisputable fact, however, that after deducting the negative cases and the old inactive cases, 13 patients are left in whom one finds an association between fistula and a pulmonary lesion, so extensive as either to have confined the patient to a sanatorium at one period of his life, or to be acutely active

at the time of this examination. In other words, in this short series, from which, of course, no generalization is possible, there is an association of these two lesions in approximately 42 per cent of the total number of cases.

A careful histological study was made of tissue removed in ten cases of fistula from the above series, all but two of which were from the groups who had either active or inactive tuberculosis. Of these ten cases only one was reported as being typically tuberculous upon microscopic examination. The others were diagnosed as chronic granulation tissue, non-specific in character.

In a number of acute perirectal abscesses, the lesion that is in a great majority of cases the antecedent of fistula, stains from the pus obtained at operation were negative for tubercle bacilli. In two of these cases, pus was aspirated from the abscess with precautions against contamination, and then inoculated immediately into guinea pigs. One of these animals survived and showed no evidence of tuberculosis. The second died in twenty-four hours of acute sepsis, but showed no evidence of tubercle infection, the time elapsed, of course, being too short for such evidence to develop, had the infection been present. It will be recalled that Hartman and Lieffring (4), quoted above, found tubercle bacilli in seven out of twelve perirectal abscesses by animal inoculation, but the type of abscesses they describe were much more indolent, more like "cold abscesses" than the cases we have worked with.

The writer has now presented the material facts on which this paper rests, namely the widely divergent opinion sustained by opposed authorities with their various data, and the personal experience of the writer himself. The harder task, that of seeking some clear evaluation of the collected material, without which its mere collection is of relatively little interest, must present itself. To return to the phraseology of the opening paragraphs of this paper, that task may be concisely expressed by asking: What percentage of fistulae is definitely tuberculous? What percentage is probably tuberculous, but not definitely so; and on what criterion is this determination based?

It is quite evident from the divergence of the foregoing opinions that either of two standards may be and have been used by writers upon the subject. There are those who like Elting (17) and Frey (22) hold to the strict formula of histological pathology, refusing to recognize any lesion as tubercular that does not show local evidence of a specific nature,—caseation, giant cells, definite tubercles, demonstration of the

bacilli, and so on. At the other extreme are those who would hold the coincidence of fistula with even the most remote and equivocal evidence of tuberculosis (remote both as to time of occurrence and anatomical locality, and equivocal as to its tuberculous nature) to constitute further evidence of the etiological rôle of tuberculosis in fistula in ano. As usual, the truth probably lies between these extremes.

The first or skeptical group go far toward answering our first question: How many fistulae are definitely tuberculous? For it surely is a fair assumption that one is not justified in ascribing a specific character to any lesion, with absolute finality, unless the diagnostic features of such specificity can be demonstrated. Any other extension of the use of the term "definitely tuberculous" would be unscientific and unsettling to the basis of all comparison. With this definition then the following facts stand out: Elting, in 105 cases, found nine definitely tuberculous; Frey, in 72 cases, found five definitely tuberculous; the present writer, in ten cases, found one definitely tuberculous. Together this makes a total of 187 cases, of which fifteen were specific, or almost exactly 8 per cent. It may be assumed that this is about the accurate answer to our first question. It is true that Melchior found tuberculosis in five out of ten cases examined, but the context shows that the only cases examined were those in which the local lesion looked highly suspicious. In the same way, Quénu and Hartman report four out of six fistulae examined as histologically tuberculous, but all these cases were known to have active pulmonary tuberculosis. In short, both these small series of cases are selective and hence without general application.

But while agreeing that there is probably not over 10 per cent of fistulae in ano that can be definitely proved tuberculous, it does not seem possible to agree with the opinion that this represents the only relationship between the two conditions. It is hardly justifiable to disregard as utterly valueless the long tradition of an association of some sort between tuberculosis and fistula, the strong belief in this association held by many men as a result of great clinical experience in rectal diseases, and finally the published data and opinions such as have already been presented, especially in the article of Melchior. In fact, one must grant that there is such an association, in addition to the cases definitely tuberculous on microscopic examination. Surely the incidence of active pulmonary tuberculosis does not run as high as the percentages reported by Melchior, Hartman and the present writer,

in relation either to the average normal population, or any other non-tuberculous lesion. One does not find from 30 per cent to 60 per cent of other chronic non-tuberculous lesions coincident with active phthisis. One may safely say then that besides the fact that a small percentage of fistulae are definitely tuberculous, a larger number occur in association with tuberculosis elsewhere in the body.

Does this mean that every fistula occurring in association is to be regarded as tuberculous in origin, or directly related to infection with the tubercle bacillus? Such an inference is clearly too broad. Frey is certainly justified in his criticism of Melchior for regarding as tuberculous fistulae not only the cases showing pulmonary lesions at the time of activity of the fistula, but even those first developing lung trouble a long time after the fistula has been subjected to operative cure. He justly objects that tuberculosis is such a common disease that surely it may attack persons having fistula, or any other lesion, without there being a causal relationship between diseases. But allowing for this accidental coincidence of the two conditions, there is still too great a coincidence found by too many observers to escape the conclusion that a goodly number of patients suffer with both lesions, because there is a probable causal relationship involved. It is purely a matter of speculation as to what this number is, because there is no present criterion of distinction between the causal and the casual coincidence. As a matter purely of speculation, however, based on a reasonable amount of personal experience and extensive acquaintance with the opinion of others, the writer would hazard the estimate that these probably tuberculous fistulae constitute roughly from 15 per cent to 30 per cent of all fistulae cases.

Numerous explanations have been advanced to account for the relationship of the two lesions, and also to explain the difficulty of proving its existence. The latter point is perhaps sufficiently elucidated by the theory that many fistulae that originate as tuberculous lesions soon become secondarily infected to such an extent that the ordinary inflammatory tissue reaction entirely obliterates the specific characteristics of the primary tuberculous lesion, and thus renders its direct recognition as such impossible. The attempts to find a reason for the frequent association of tuberculosis and fistula are more various and less convincing. Some see in swallowed sputum or infected food a modus by which small lesions in the ano-rectal region became infected. Others invoke the theory of blood stream or lymphatic infection of a region

often congested, or where a *locus minoris resistentiae* is established from the wasting of perirectal fat consequent to pulmonary tuberculosis. Again it has been suggested (by Dr. Krause of the Phipps Tuberculosis Dispensary in private conversation) that infection may be a direct local inoculation from the hands of the patient with an active pulmonary lesion or from infected material used in the toilet. All these views regard the fistula as secondary to the pulmonary lesion. Somewhat similar is the idea that the fistula is not itself a tuberculous manifestation, but is more apt to occur in victims of pulmonary tuberculosis because of their generally lessened vitality. Against this is the evidence of Melchior and others, including the writer, that the fistula may precede the evidences of lung trouble. The whole matter is seen in quite the reverse aspect by a number of others, who consider that the fistula of a non-specific character, so deteriorates the patient's general health as to render him an unusually frequent victim of pulmonary infection. Also regarding the local lesion as primary, but as frequently specific itself, is Volkmann, who says, as quoted above, "a portion of fistulae has from the beginning the nature of tuberculous ulcers." In the absence of any method of proof, it is not unreasonable to suppose that in various instances the actual facts may conform to one or other of these theories, probably no one of which has universal application.

SUMMARY

It is probable that definite tuberculosis cannot be demonstrated in more than 10 per cent of all fistulae.

In a much larger percentage there is some relationship between fistula and tuberculosis, and in perhaps 15 per cent to 30 per cent of all cases this relationship is fundamental and not merely coincidental.

Various theories have been advanced to explain this relationship, but none has been proved.

In a considerable, but at present inestimable, percentage of cases there is no relationship whatever between fistula and tuberculosis.

(In conclusion, I wish to express my gratitude to the departments of roentgenology and surgical pathology of the Johns Hopkins Hospital for assistance in examinations, and also to the Phipps Tuberculosis Dispensary, in charge of Dr. Allen K. Krause, for coöperation in careful

physical examination of many patients. Dr. Charles R. Austrian of the Phipps Dispensary, who did most of this work personally, has been particularly helpful in supplying careful and complete notes.)

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MEDICAL NOTES, ABSTRACTS AND REVIEWS

It will be the eventual purpose of the REVIEW thoroughly to canvass all literature on tuberculosis as it appears in other medical periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the Abstract Editor, Dr. George Mannheimer, 41 West 51st Street, New York, N. Y.

Pseudotuberculoma.—Shattock reports the case of a healthy athletic man, who in 1915 had been thrown from a bicycle and received an injury to the inner side of the lower lip, with spitting out of blood and sand after picking himself up. After using a mouth wash the injury healed in about two weeks. Early in 1916 he became aware of a lump in this position, which he associated in his mind with the receipt of the injury. On the inner aspect of the lower lip, just above the fraenum, there was a round tumor over which the skin was perfectly movable.

A section showed large multinuclear giant cells of uniform structure, giant celled systems and aggregate systems, such as construct a miliary tubercle. Regularly distributed throughout the new formation, numbers of transparent, angular, colourless particles were found, which consisted of silica.

In addition to the swelling of the lip, there were excised two submental lymph-nodes, which were slightly enlarged and showed on microscopic examination small groups of silica particles.—*Pseudotuberculoma, S. G. Shattock, Proc. Roy. Soc. Med., January 1917, x, No. 3, 6.*

False Pulmonary Tuberculosis.—Carles refers to patients who cough and present all the signs of active tuberculosis, and yet the trouble is merely the spread downward of some chronic trouble in the nose. Sinusitis, rhinitis, adenoids, the tonsils, may be responsible. On the side on which the patient usually lies, the lung shows signs of involvement, especially at the hilus, and the diagnosis of tuberculosis seems certain. The sputum shows no tubercle bacilli and treatment of the nose, sinus or tonsils is soon followed by the retrogression of the lung symptoms, or a focus of sclerosis may persist indefinitely. True tuberculosis may become installed if the primary condition is allowed to go untreated. Carles has encountered several cases in the last year or two in which typhoid or paratyphoid bacilli kept up a chronic congestion in the lungs simulating tuberculosis. In a recent case a simple congestion of the apex during a typical paratyphoid fever, dragging through several weeks, presented the clinical picture of "galloping consumption." All returned to normal as the paratyphoid ran out is course. In another case of supposed pulmonary tuberculosis with hemoptysis and softening of the apex on both sides, the sputum has shown only pneumococci in the year or more the patient has been under observation. In these penumococcus cases, inhalation treatment and tonics generally cured the patients completely in time.—Pseudo Tuberculosis of the Lungs. J. Carles.—*Jour. de Med. de Bordeaux, February, 1917, no. 2.*

The "Zone of Alarm" in Tuberculosis.—This term was originally applied to a certain area in the apex of the lung by Chauvet. Labro in a Paris thesis recently issued (Étude de la "zone d'alarme" de Stephan Chauvet, Paris, 1916) has written up the subject anew under the direction of the well-known phthisiologist Sergent. Of all the minor regions comprehended under the term apex, the most significant for early diagnosis is the upper, internal portion of the supraspinous fossa. Its value is three fold. In the first place it gives clincial information; secondly, it plays a part in the physique of the consumptive; finally, it is important for radiography. When about to examine a tuberculous suspect one should first bear in mind that the "zone of alarm" simply represents the extreme projection of the apex. If the physical signs are limited to this locality, it is an excellent prognostic omen, for there is time to save the patient. He will at this stage respond to appropriate treatment. But it is not only in the earliest stage of the disease that this region is significant; for even when the lung is beyond doubt well infected the zone of alarm will still give the most trustworthy evidence of the march of the tuberculous invasion, because it re-

flects the latter in its own progressive alterations.—*Editorial, Med. Rec., February 24, 1917, xci, no. 8.*

Experimental Lymphogenous Propagation.—It is generally believed, that infection of parenchymatous organs, especially liver, spleen and kidney, takes place by way of the blood-stream. For the lungs lymphogenous infection from the bronchial nodes is assumed. This is due to the current opinion, that the lymph flows constantly in a peripheral direction from the organs to the neighboring lymph-nodes, and thence to the main lymphatic trunks. Cornet, however, and Tendeloo have pointed out the importance of lymphogenous infection. They have overthrown the idea of a uniformly constant direction of the lymph-flow. The latter is subject to mechanical influences like respiration, intraäbdominal pressure, changing fullness of the gastro-intestinal tract and moves in an ascending and descending direction, ever variable. There is a connection between the nodes of the head, neck, chest and abdomen, and the retroperitoneal space. Ziegler confirmed these views of Tendeloo through a series of experimental inoculations of guinea-pigs, rabbits and dogs with weakly virulent tuberculous material. The infection spread gradually by way of the lymphatics first into the regionary lymph-nodes and then into liver, spleen and lung, more rarely into kidneys and salivary glands. If the infection proceeds from the mesenteric and omental tissues, the peripancreatic nodes are first affected and from them spleen and liver; simultaneously the bronchial nodes and from them the lungs through the peribronchial and pleural lymphatics. If the retropharyngeal tissue is inoculated, the cervical nodes are affected first and from them cranially the nodes below the chin and around the salivary glands, caudally the supraclavicular retrosternal and bronchial nodes with the lungs as well as the peripancreatic nodes with liver and spleen. From the primarily inoculated deep cervical nodes the process spreads along the lymphatics situated in front of the spinal column into the nodes around the aorta as far down as its division, and from there into the kidneys, principally the capsule and hilus-tissues. These experiments prove: (1) The lymphogenous infection of parenchymatous organs; (2) the intercommunication of the lymph-systems of head, chest and abdomen outside of the serous cavities; (3) the inconstancy of the direction of the lymph-stream. Results of these animal-experiments were proved to hold good for man in the case of a tuberculous patient, who came to autopsy and whose findings are reported in detail by the author.—*Infektionswege experimenteller Impftuberkulose, zugleich ein Beitrag zur Lehre von der Lymphbewegung. Ziegler, Med. Klin. 1916, no. 41. (Translated from Internat. Centralbl. f. d. ges. Tuberk. Forsch.)*

The Frequency of Tuberculous Infection of the Lungs.—The old tradition that "every one has a little tuberculosis" was converted into a demonstrated fact not many years ago by careful anatomic studies. In 1900, Naegeli in Zurich reported that he had found recognizable tuberculous lesions in 97 per cent of the bodies examined by him. Although this statement did not at once receive universal acceptance, and much lower figures were reported by others, yet it is now generally recognized as being quite correct, other pathologists, especially Burkhardt, having obtained similar results. Until recently we have lacked comparable investigations on the population of this country, where, in view of somewhat different living conditions, the incidence and behavior of tuberculosis might perhaps be different. An interesting study of a relatively small number of bodies by Opie in St. Louis, however, has established the universality of tuberculous infection in that community. Opie's material, while smaller in amount than that of the German observers, is of particular value, because, by making roentgenograms of the lungs under examination, lesions were located much better than they can be by unaided dissection.

As pointed out by Ghon in his important monograph on pulmonary tuberculosis in children, the lesions in the lungs during the first few years of life may occur in any part of the lung, and usually are accompanied by involvement of the lymph glands that receive the drainage from this area, this lymphatic tuberculosis usually being extensive and often dominating the tuberculous process. In ninety-three children under eighteen years of age, Opie found that eleven children had died of tuberculosis, and that of the remaining eighty-two children dead from other causes, eleven showed tuberculous lesions. The nonfatal tuberculous lesions were found only in children over two years of age, and increased in proportion as age advanced; that is, of the children from two to five years of age, 27 per cent showed nonfatal tuberculosis, those from five to ten years old showed 33 per cent incidence, and those from ten to eighteen years old, 62.5 per cent. Of fifty adults, however, every one showed recognizable tuberculous lesions. In the adults, however, two distinct types of tuberculous

lesions were recognized. One type, consisting of encapsulated caseous or calcified tubercles, with a correspondingly late type of lesions in the nearest lymph glands, seems to represent unquestionably healed or latent childhood infections. The other type is the familiar apical lesion, tending to spread diffusely through the apex and unaccompanied by caseation or calcification of the regional lymphatic nodes; this lesion may heal completely, progress to a fatal termination, or remain in a latent condition. The apical type of pulmonary lesion is not found in young children, but increases in frequency with age. In many adult bodies, both types of lesions are found.

From these observations the prevailing opinion that our resistance to tuberculous infection during adult life is due to a more or less complete immunization through infections received and overcome in youth receives strong support. It is seen that tuberculous infection, active, latent or healed, is practically always present in adults, and that, in adults, infections take on a different character from the infections of childhood. In the young person infected for the first time with tuberculosis, the lesion assumes the features seen in susceptible animals inoculated with tubercle bacilli, for the infection spreads to the regional lymph glands and usually produces considerable caseation before it is overcome by the development of a specific increase in resistance. In the adult, presumably because of the persistence of this acquired partial immunity, the apical lesion usually pursues a chronic course and does not spread to the lymph glands; this is a characteristic of second infections in animals already tuberculous which was observed first by Koch. The healed tuberculous lesions found in the lungs and peribronchial glands of adults are truly vaccination scars.—*Editorial, J. Am. M. Ass., June 23, 1917, lxviii, no. 25, 1913.*

X-Ray Study of Tuberculous Extension.—The shadows seen in x-ray plates of the lung are produced by blood, connective tissue, or lime salts. Those produced by connective tissue may be the result of deposition of lime salts. Tubercles are not seen in x-ray negatives; what we see is the result of tuberculous inflammation. To understand clinical tuberculosis we must approach it from the standpoint of immunity. In the thoroughly immune individual in perfect health tubercle bacilli are shut up in bronchial glands. When the resistance is lowered the bacilli will develop under conditions most favorable for them. These conditions are: (1) The proximity of large collections of bacilli. (2) Extension will occur in locations in which they are shielded as far as may be from contact with antibodies, i.e., in non-vascular regions. (3) They will seek locations which are not subject to motion, where the lung undergoes little expansion. We have then the following subdivisions of tuberculosis of the deep lung: (1) Tuberculosis limited to the bronchial glands. (2) Tuberculosis capable of extension in parts of least motion—paravertebrally upwards. In the highest immunity the process is strictly a tuberculous lymphangitis of the bronchi. (3) Tuberculosis extending upwards and outwards as well as directly upwards. The ability of the bacilli to maintain themselves in parts of greater mobility speaks for lesser immunity. (4) Tuberculosis extending peribronchially in all directions. Abortive cases will be limited to the lymphatics, but as a rule the process quickly becomes a tuberculous broncho-pneumonia. Lapses of immunity may lead at any time to pneumonic processes and confuse the picture. Typical tuberculosis of the upper lobe is a broncho-pneumonia developing upon a peribronchial lymphangitis of a paravertebral bronchus, the conditions in the upper part of the upper lobe being especially favorable for invasion of the parenchyma because of the relative immobility of the part in the adult.—*Extension of Tuberculosis of the Lungs as Shown by the X-ray Col. G. E. Bushnell, Southwest. Med., May, 1917, i, no. 5, 15.*

Immunity in Tuberculosis.—There is no real specific immunity in tuberculosis, and none can be produced by any tuberculin product. Tuberculin tolerance is not an immunity, since no antibodies to tuberculin are formed. The defense of the organism against the tubercle bacillus seems to be a complex of its habitual defensive reactions, the organism offering one mechanism of defense after another to the invasion of the germs and its toxins. The lymphatic system and the blood are some of the means of defense and show a general germicidal reaction, including the tubercle bacillus.—*Immunity in Tuberculosis. D. C. Twichell, Southwest. Med., July, 1917, i, no. 7, 17.*

Reinfection and Immunity.—From a large material the author attempts to prove that tuberculous reinfection is an exogenous and not an endogenous process in the sense of Roemer. Pathologic anatomy teaches, that almost all adults are infected with tuberculosis. Statistics prove that infection leads to disease much more frequently in children of tuberculous parents than in

others; furthermore that the disease runs the same course in the hereditarily predisposed and in those who are not; e.g., that there is no inherited diminution of resistance against the disease. The higher morbidity of the predisposed is due therefore to increased exposure, not to increased disposition. This is corroborated by the following two statistical observations: (1) among the children of consumptives, the girls are much more frequently affected, because they are more exposed than boys on account of their house-work. (2) Paternal predisposition outranks maternal. This is due to the fact that working-men, in consequence of smoking, alcoholic indulgence and harmful occupations, produce larger quantities of sputum and are less careful in its disposal than women.—*Reinfektion und Immunitaet bei Tuberkulose. F. Reiche, Med. Klin., 1916, no. 40. (Transl. from Internat. Centralbl. f. d. ges. Tuberk. Forsch.)*

Rôle of Lymphoid Tissue in Tuberculosis.—Experiments seem to prove that the lymphoid tissue increases the resistance to tuberculous infection. Splenectomized mice, after exposure to repeated doses of x-ray, which has been shown to affect primarily the lymphoid tissues, proved to be more susceptible to tuberculous infection than normal animals or animals splenectomized alone. Intact x-rayed mice were likewise highly susceptible to infection with the bovine tubercle bacillus. A pronounced non-specfic lymphocytosis, brought about by the inoculation of cancer-immunized mice with one of the transplantable mouse cancers, greatly enhances the resistance to tuberculous infection. That the lymphocytic reaction is responsible for the increased resistance to infection is proved by the fact that when the cancer immune animals were subjected to a series of small doses of x-ray their susceptibility to tuberculous infection became even greater than that of normal animals. Various investigators have shown that the number of lymphocytes in the blood varies in proportion with the amount of resistance and may, therefore, serve as a prognostic criterion in tuberculous patients. Thus in cases of advanced tuberculosis, as well as in miliary tuberculosis, the number of lymphocytes per cubic millimeter of blood has been known to reach as low as 250 to 500.—*Experiments on the Rôle of Lymphoid Tissue in the Resistance to Experimental Tuberculosis in Mice. H. D. Taylor and J. B. Murphy, J. Experim. M., May 1, 1917, xxv, no. 5, 609.*

Uses and Abuses of Sanatorium Treatment.—In the report of the Midhurst sanatorium ending July last, the cases were divided into two groups, according to the presence or absence of bacilli in the sputum. Every effort has been made to keep in touch with the patients after their discharge, and during the last nine years over two thousand cases have been watched, with the result that of the positive cases only about 41 per cent were found to be still living in 1916, as against 74 per cent of the negative cases. Comparison of the many reports issued of late years by other sanatoria would seem to indicate that the high water mark of success in treatment has been reached, and in the last few years there has been no notable change with regard to the general death rate. The obvious inference to be drawn from these facts is that the present methods for the suppression of tuberculosis are inadequate. The disease itself should be nipped in the bud by prompt sanatorium treatment of early cases. At Midhurst it would appear that about 73 per cent of the third stage cases were found to have died during the nine years, and many of these had only survived for a year or two after discharge. Sanatoria should be strictly limited to cases in which arrest of disease are probable. The other cases are to be admitted to chest hospitals and sick asylums, and the care of their maintenance may be well borne by voluntary contributions, until such time as the State may be in a position to provide adequately for segregation. Another defect of the present system, as emphasized in a recent report by the tuberculosis officer for Wigan, is the late notification. Over 40 per cent of the cases examined for the first time by the tuberculosis officer were found to be in the third stage. The earlier stages have been diagnosed as bronchitis or debility. Another difficulty has been met with in dealing with tuberculous ex-soldiers, who, having received their pensions as consumptives refuse to submit to sanatorium restrictions. The suggestion is made that payment of such pensions should be conditional on treatment being fully carried out, or that military patients should be kept under military control until fit to undertake remunerative work.—*Leading Article. Brit. M. J., April 14, 1917, 484.*

Nontuberculous Cases in a Hospital for Advanced Consumptives.—There are still too many nontuberculous cases sent into tuberculosis institutions. The author reports from the Montefiore Home and Hospital six illustrative cases, viz., one of cancer of the lung, two of bronchiectasis and three of arrested incipient disease.—*Nontuberculous Cases in a Hospital for*

Advanced Consumptives. J. Kramer, N. York, M. J., June 23, 1917, cv, no. 25, 1202.

Morbidity Statistics of Hospitals.—Hospitals and sanatoria for the exclusive treatment of tuberculosis, mental diseases, cancer, drug addiction and other special diseases, have an opportunity for service to their individual fields and to the public health movement.

Prof. Karl Pearson in his *The Fight against Tuberculosis and the Death Rate from Phthisis* questions the place of sanatorium treatment of tuberculosis in the general movement for the study and control of the disease. Dr. Lee K. Frankel in his *Plea for a Federal Commission on Tuberculosis* asks us to reassemble our facts on the public health aspects of tuberculosis and determine whether we should proceed along the lines we have laid down or establish new criteria, and new bases for future action. The special hospitals for tuberculosis should, therefore, enter upon a comprehensive coöperative effort to study their experience data.

The tuberculosis hospitals have the advantage of considerable preliminary work in the standardization of nomenclature through the work of the National Association for the Study and Prevention of Tuberculosis and of the American Sanatorium Association. This work can be made to bear fruit in a coöperative statistical study in association with the Federal voluntary registration area for hospital morbidity statistics.—*Morbidity Statistics of Hospitals: The Need for Morbidity Statistics of General Hospitals, Special Hospitals, Sanatoria, etc., and Means for Their Collection and Publication. Edwin W. Kopf, U. S. Publ. Health Rep., June 15, 1917, xxxii, no. 24.*

Establishment of County Hospitals for Tuberculosis Mandatory under New State Law.—Passed as a war measure so that the state will be prepared to treat all cases of tuberculosis discovered in examining men drafted for the army or who are found in the army itself, an amendment to the County Tuberculosis Hospital Law was enacted at the recent session of the New York State Legislature providing as follows:

"Establishment of County Hospitals for Tuberculosis. The Board of Supervisors of every county in the state containing a population of thirty-five thousand or more, as determined by the latest state census, shall establish, as hereinafter provided, a county hospital for the care and treatment of persons suffering from the disease known as tuberculosis, unless there already exists in such county a hospital or institution provided by the county or other authority and caring for persons suffering from tuberculosis, which is approved by the state commissioner of health. Such county hospital shall be available for patients on or before the 1st of July, 1918. If the board of supervisors of any such county shall have failed to secure a site for a county tuberculosis hospital, and to have awarded contracts for the erection of suitable buildings thereon by the 1st day of January, 1918, it shall be the duty of the state commissioner of health forthwith to proceed to locate, construct and place in operation a tuberculosis hospital in and for such county, the capacity of which shall not exceed the average number of deaths per annum from tuberculosis in such county during the past five years. For such purposes the state commissioner of health shall possess, and it shall be his duty to exercise, all the powers which would have been possessed by the board of supervisors of such county, had such hospital been established and placed in operation by the board of supervisors thereof. All expenditures incurred by the state commissioner of health for and in connection with the location, construction and operation of such hospital shall be a charge upon the county, and provision shall be made for the payment therefor by the board of supervisors of such county in the same manner as in the case of other charges against the county. At any time after such hospital has been in operation, the board of supervisors in such county may appoint a board of managers for such hospital pursuant to the provisions of this act, and thirty days after the appointment of such board of managers by such board of supervisors, such hospital shall be transferred to such board of managers, and such board of managers shall thereafter possess and exercise all the powers of the board of managers of a county hospital for tuberculosis under this act, and the state commissioner of health shall be relieved from any responsibility therefore except such responsibility as he exercises in regard to all county tuberculosis hospitals under the provisions of this act."

The new law affects twenty counties, eight of which had previously taken various steps leading to the erection of a hospital, but had not yet let contracts.

The State Charities Aid Association has issued a pamphlet entitled "A Compilation of the Laws of the State of New York Relative to County Tuberculosis Hospital as of June 1, 1917." A copy may be secured from the Association upon request addressed to 105 East 22nd Street, New York City.—*Weekly Bull. of Dept. of Health, N. Y. City, Sept. 1, 1917.*

A County Tuberculosis Hospital—The Nopeming Hospital for Tuberculosis at Duluth, Minn. has a capacity of 120 beds, and in another year there will be accommodations for 200 patients. The features of the institution to which special attention is called as desirable in a county sanatorium are: the centralization of the care of bed patients in buildings closely connected with the administration center; the provision of fresh air treatment for all cases, even the far advanced; the construction of buildings so that fresh air treatment can be carried out easily; the utilization of cottages and of a tent camp for certain ambulant cases; special provision for the care of tuberculous children from the opening of the institution; the provision of suitable occupation for convalescent patients. A free clinic in coöperation with the city health department provides opportunities for early diagnosis, and simplifies the matter of keeping in touch with discharged patients. It constitutes the social service department of the sanatorium.

The cost of buildings already in use has been as follows:

Administration building	$48,096.45
Children's cottage	12,060.32
Infirmary	37,953.75
Boiler house and heating equipment	24,354.87
Four patients' cottages	10,600.00
	$133,065.39

This does not include the cost of site, water supply, or sewage plant. The maintenance cost in 1915, excluding permanent equipment purchased, was $1.67 a day per patient.—*Nopeming Hospital for Tuberculosis at Duluth, Minn. A. T. Laird and W. L. Sullivan, The Modern Hospital, March, 1917, viii, no. 3.*

County Sanatoria in Minnesota.—The progress Minnesota is making in the campaign against tuberculosis is well illustrated by the increase in the number of beds from 454 on September 1, 1915 to 875 this year. In addition, municipal, asylum and private hospital beds bring the total up to 1460 which is 66 per cent of the annual deaths. Several other sanatoria are to be completed before the end of the year. The provisions of the law, allowing State aid for both construction and maintenance, have done much to encourage many counties which would otherwise be still hesitating. The law requires county institutions to give preference to advanced cases. This is one of the first steps to be taken in the eradication of the disease. To supplement this work the Free Dispensary is necessary. This would enable those patients who can not be admitted to the sanatorium as well as those discharged as "quiescent" to be under a physician's care. Many of the cities have already established such dispensaries. Preventoria should be established in connection with sanatoria where the strength of the children will be built up. The milk supply should be carefully supervised and all herds tested by veterinarians. There is no routine treatment of tuberculous patients. Their symptoms vary from day to day and must be treated as they arise. Above all training and instruction are required.—*The County Sanatoria. Their Opportunities and Needs. L. G. Guier, St. Paul M. J., April, 1917, xix, 4, 116.*

State Tuberculosis Institutions in Massachusetts.—The new County Hospital Law, providing accommodations for a large number of the smaller communities, does away with the disadvantages which are inherent in the management and maintenance of small institutions. When the hospitals provided for by this law are built, the policy of the state of Massachusetts as far as tuberculosis is concerned will be some what as follows: cities of over 50,000 inhabitants are required by law to maintain a tuberculosis hospital of their own and are expected to care for all their advanced cases, many of their moderately advanced cases and all emergency cases, and others awaiting admission to a state or county institution. The county hospitals will care for the advanced and emergency cases coming from the smaller communities and the scattered rural districts. This will leave the state sanatoria to do the work for which they are really intended, i.e., the cure and arrest of favorable cases of consumption, and not merely segregation, which, to a large extent, is all that they are doing at present.—*Editorial, Boston M. & S. J., April, 19, 1917, clxxvi, no. 16.*

Home Hospital Report.—From March, 1912, to October, 1916, the total number of cases treated was 185. The number who were under treatment for over three months and who have followed advice amounted to 140. Of these, 60 were discharged arrested; 25, apparently arrested; 15, quiescent; 13, improved; 17, unimproved; and 10 died. Of the 10 deaths, one was classed on admission as incipient; 6 as moderately advanced; and 3 as far advanced. Of the 153 families cared for, 18.9 per cent of the consorts presented evidence of active or healed pulmonary tuberculosis. Prior to admission 3.3 per cent had lost consorts due to the disease. During the residence at the hospital of these 153 families eleven

pregnancies occurred. Thirteen cases relapsed after discharge, of whom 3 died, 3 are now quiescent, 1 arrested, 2 active, and 4 unknown.

Among the tuberculous complications the most common were: tuberculous laryngitis, 3 cases; adenitis, 2; fistula in ano, 2; Pott's disease, 2; and pneumonia, 2. The most common non-tuberculous complications were: heart disease, 23; otitis media, 15; rubeola, 18; varicella, 13; pregnancy, 11; pneumonia, 12; mumps, 12; trachoma, 10; rheumatism, 8.—*The Medical Report of the Home Hospital from March, 1912, to October, 1916. N. Y. Ass. for Improving the Condition of the Poor. Publication No. 117.*

The Home Hospital.—The pamphlet attempts to give in picture form some idea of the work of the Home Hospital. Opened in March, 1912, doubled in size twice since that date, it now cares for nearly eighty families, including about 400 individuals approximately two-thirds of whom are tuberculous.

The Home Hospital is an outgrowth of the social idea gaining ground in so many different ways that the home is, after all, the most natural and the most effective place to care for many classes of dependents for whom institutions were formerly the only alternative. It grew out of dissatisfaction with results obtained in dealing with family relief problems in which tuberculosis was a factor. It was a confession of relative failure—an earnest effort to do something constructive about the failure. It frankly raised the question whether in suitable cases tuberculosis cannot be successfully treated as a family problem without endangering the health of well members of the family, and it believes that its four and one-half years of experience warrant the conclusion that this is quite possible. It has at the same time demonstrated that results secured in the treatment of actual patients compare, group by group, very favorably with those secured by the best hospitals, sanatoria and preventoria.

The Home Hospital has shown that nearly one-third of the children in dependent families in which one or both parents have active tuberculosis are themselves already patients, and much more than another third are delicate and under-nourished and present some of the symptoms of tuberculosis in children. It would seem that it is around the continuous and effective treatment of these children that future progress in the control of tuberculosis centers. The intensive method of the Home Hospital offers, we believe, the greatest possibilities for dealing with this problem of successfully preventing a large crop of tuberculosis in the next generation.

SUMMARY

It would seem that the Home Hospital method of treatment is a valuable supplement to the already existing agencies since in suitable families it offers an excellent substitute for hospital, sanatorium and preventorium treatment. From the results obtained during the past four and one-half years the following conclusions would seem justifiable:

1. Since so far as is known no individual not previously infected with tuberculosis has developed symptoms of the disease while a resident at the Home Hospital, it would seem that under proper medical and nursing supervision tuberculosis may be treated in homes without serious danger of infecting well members of the family.

2. Since the condition of the children has been so greatly enhanced the Home Hospital affords treatment at least the equal of preventorium care. Moreover, adequate corrective work is accomplished.

3. Since most of the incipient and many of the moderately advanced cases have been restored to health the medical results compare most favorably with those of the best sanatoria, and finally

4. Since so much has been accomplished in the social and economic rehabilitation of the families, the medical and economical practicability of the Home Hospital method of treatment seems to have conclusively demonstrated its real practical value in the treatment and control of tuberculosis in urban communities.—*The Home Hospital. An Experiment and Demonstration in the Home Treatment of Tuberculosis, March, 1912–October, 1916.—N. Y. Ass. for Improving the Condition of the Poor. Publication No. 116.*

Home Management of Tuberculosis.—The proper management of all infectious diseases in the home resolves itself into placing the home on a hospital basis with all the care and cleanliness which that implies, and to convert a tuberculous patient's home into a tuberculosis sanatorium is the ideal management of tuberculosis in the home. There are all sorts of homes and all sorts of patients, and the management must be so ordered as to fit the conditions. A large, airy room, well lighted and ventilated, with proper arrangements for disinfection of vessels and disposition of sputa should be ordered. There are great obstacles in the way of managing the patient properly. Isolation is difficult to enforce,

and contact with members of the household is not easy to prevent. The physician should undertake his task with cheerful encouragement and sympathy combined with the firmness necessary to cause his authority to be recognized and to enable him to gain and hold control of both the patient himself and the entire family; persuading, entreating and even commanding as may be needed. Directions concerning rest and exercise should depend upon the temperament and previous habits of the patient. A man who has led a life of activity for years will be more harmed than benefited by enforced rest. Reasonable rest, reasonable exercise, changing from one to the other dependent upon the state of mind will meet the indications. Deep inhalations and chest exercises are beneficial; the claim that they are liable to spread infection to healthy parts of the lungs seems to be unfounded. The room should be stripped of all unnecessary furnishings. Finally the telephone is an important means of spreading infection, especially the public telephone booth.—*The Management of Tuberculosis in the Home. W. R. Cushing, Virginia M. Semi-Monthly, June 8, 1917, xxii, no. 5, 111.*

The Camp Idea in Tuberculosis.—The value of the open-air school, both in the winter and in the summer months, for either the poorly developed or the tuberculous child, has been amply justified by the results reported in Boston and in Chicago, and wherever else it was tried. Similar results have been accomplished in the reclamation of the child exposed to tuberculosis, in the preventoria maintained in many places. Not only have these children become well and strong, but their scholastic attainments have approached well within the standards of normal children. Whether the open-air treatment is administered to children in the open-air schools or in the preventoria, or to adults in day camps, it is the open-air treatment that holds the greatest hope for recovery. For the well-marked active case, whether in children or in adults, there is no other method of treatment but the outdoor method. During the active stages neither the child nor the adult can afford to engage in educative pursuits or in any occupation. But for the arrested case or for the child or adult that is on the mend, it is neither right nor desirable to withhold education or occupation. For the adult, suitable work prevents his ultimate pauperization and prevents him from being a burden to himself, his dependents, or to society. Otherwise his reclamation would be a mistake rather than a benefit. For the child, the absence of education during the formative period of his life would be to throw it hopelessly in the mentally backward class. It is to these classes that the day-camp idea is of the greatest benefit.

But unless the day camp is supplemented by the night camp, the value of this method of treatment must fail, for the patients must return to their homes at night, where conditions are the same as those which undoubtedly caused the original infection. These patients can again become sources of infection, and of greater degree than even much worse contact during the day. Moreover, the night camp would afford a place for the tuberculous case that is allowed whole-day employment. None of the artificial open-air sleeping contrivances for use in the congested homes can quite equal the value of sleep entirely in the open air, under the same conditions as obtain in the day camps. This method of treatment for the arrested cases would prevent a great many of them from becoming reactivated after a short period of occupation, and would undoubtedly broaden the scope of occupations allowed these individuals. The night camp must be a graduation from the day camp, at least where both cannot be given. The ideal substitute for the sanatorium climatic treatment, where this cannot be afforded, are the day and the night camps. Besides hurrying recovery and reducing the chances of secondary infections, the camp idea would afford more room for the well members of a tuberculous family, in homes where room is usually at a premium.—*Editorial, Boston, M. & S. J., July 26, 1917, clxxvii, no. 125.*

Michigan's Tuberculosis Campaign.—Discusses the tuberculosis survey carried out during two years in Michigan by the State Board of Health under a grant of $100,000 from the State.—*Michigan's Part in the War on Tuberculosis. Arnold Mulder, Am. J. Pub. Health, Feb., 1917, vii, no. 2, 182.*

Brooklyn's Tuberculosis Campaign.—Discusses the educational campaign carried on among the children of Brooklyn. The giving of health talks and of playlets and the use of posters have been developed. A brief sketch of the work of the sanatorium at Medford and the Day Camp Rutherford is given.—*Educational Work of the Brooklyn Anti-Tuberculosis Committee. H. D. Jenkins, Am. J. Pub. Health, Feb., 1917, vii, no. 2, 187.*

The Framingham Experiment.—Outlines the plan to be carried out at Framingham, Mass., under the grant of $100,000

from the Metropolitan Life Insurance Company.—*The Framingham Health and Tuberculosis Demonstration. D. B. Armstrong, Am. J. Pub. Health, March, 1917, vii, no. 318.*

Detection of Tuberculosis in Recruits.—Lopez comments on the high percentage of cases of pulmonary tuberculosis in the Argentine navy, and urges greater care in the selection of recruits so as to eliminate the tuberculous. He remarks that when the conscription officer and the examining physician find large numbers of unfit, the former grows nervous for fear he may not be able to make up the quota for his district. In spite of himself, this nervous apprehension becomes imparted to the examining physician, and the latter is unconsciously influenced by it and his judgment as to the compliance with the requirements for service becomes warped. This is a common psychologic phenomenon, but in its influence on the acceptance of recruits it may have disastrous consequences not only for the man himself, but for the state. The tubercle bacilli locate first in the glands at the hilus, as a rule, and attack the lower lobes oftener than the regions above, usually on the right side. But the tuberculous process here encounters so many obstacles that it develops slowly or may heal. In examining recruits the first points to be investigated are the hilus, the region around it and the base. An isolated tuberculous process at the apex is found only in a very few cases. Roentgen examination is indispensable in dubious cases to reveal tuberculous glands at the hilus, especially when the general constitution seems to be below par. Pignet's index of robusticity is a great help, but the measurements for it should always be taken with uniform technic.—*El reconocimiento de conceriptos y la tuberculosis pulmonar. J. A. Lopez, Semana Med., May 17, 1917, xxii, no. 20, 569.*

Pleuritis and Tuberculosis in Military Practice.—Reports on a special form of tuberculous disease met with frequently among soldiers. The subjects were for the most part between twenty and thirty years of age. Some had histories of bronchitis, hemoptysis, or pleurisy before the war, but in the majority the disorder had appeared since the beginning of hostilities, always insidiously and preceding by several weeks at least their admission to the hospital. The early symptoms had been gradual loss of strength and appetite, breathlessness, soon followed by cough and a pain in the side. On admission the men were pale and presented a continuous cough, with paroxysms especially at night, with scanty mucous expectoration, at times blood streaked but always free of tubercle bacilli. Dyspnea was experienced even during rest, often with a distressing sensation of thoracic oppression. Pain was uniformly present but varied in location, occurring at the lung bases as often as at the apices. Palpation and percussion were negative, but auscultation revealed a delicate, inconspicuous friction rub, widely distributed, generally present at the seat of pain, and varying in intensity from day to day. On admission only râles were heard over the large bronchi. In the interscapulovertebral space manifest signs of lymph gland hypertrophy were noted, such as bronchial breathing, bronchophony, and whispering pectoriloquy together with slight palpable enlargement and induration of the axillary and cervical lymphnodes. *X*-ray examination revealed only occasionally a slight pulmonary shadow in the area of the friction sound, but often a distinct enlargement of the mediastinal nodes. As accessory symptoms were observed dyspeptic disturbances, diarrhea and colic independent of food ingestion, and a tendency to palpitations and tachycardia, with a low blood pressure and, as a rule, a small heart. Fever was present in three-fourths of the cases and moderately copious night sweats occurred in an even larger ratio. Especially marked was an incapacity for exertion out of proportion with the condition as a whole. In a majority of instances the condition cleared up in three to six weeks under rest in warm quarters, cough sedatives, derivatives, and general tonics. Smaller groups of cases recovered more rapidly or more slowly. As the condition passed into frank pulmonary tuberculosis in but one doubtful case, and since true tuberculosis runs an extremely rapid course in the army, Beauchant does not consider the condition a preliminary stage of common phthisis, but merely a special benign form of tuberculosis, purely inflammatory and not resulting in tubercle formation. These subjects need not be relieved of active military duties, but may be ordered back to the front when their bodily strength has returned after a period of surveillance and convalescence.—*Pleurite et Tuberculose, Morichau-Beanchant. Paris Méd., April 7, 1917, no. 14, 272.*

Tuberculosis War Problem.—The causes of increased tuberculosis in Europe are: Failure to appreciate importance of tuberculosis under war conditions, failure to meet the tuberculosis problem before and during the war, lack of the necessities of life of civil population, mental and physical strain of service, insanitary conditions

in prison camps, inadequate hospital and sanatorium facilities, failure to detect tuberculosis among soldiers during enlistment and while in active service, and tendency of tuberculous persons to enlist.

The logical tuberculosis program for the United States is: (1) Appreciation of the importance of tuberculosis in war by the civil and military authorities, and by the people. (2) Establishment in every large community of hospitals, sanatoria, dispensaries, farm colonies, and after care service, under competent physicians and nurses. (3) Proper food administration and distribution, and proper sanitary supervision of the civil population, including liberal provision for wives and children of soldiers. (4) Elimination of tuberculous recruits and soldiers, and early diagnosis by adequate observation. (5) Withholding physicians and nurses engaged in tuberculosis work from military service, including specialization of tuberculosis by some physician in every community and the employment of specially trained nurses.—*The United States Tuberculosis War Problem. G. T. Palmer, M. Times, July 1917, xlv, no. 7, 185.*

Tuberculosis and War.—The question of the competency of men with inconclusive symptoms or traces of tuberculosis or history of previous attacks and treatment in sanatoriums or those with other pulmonary diseases, such as the various forms of bronchitis, asthma, etc., for military service is discussed by M. Fishberg. It is clear that those presenting symptoms of active tuberculosis are unfit but the large class of persons enumerated are apt to give trouble in deciding, to the examiner of recruits. The examiner will be on safe grounds if he relies more on symptoms, such as fever, pulse, etc., than on physical signs or even the Roentgen ray. Osler is of the opinion, that some actively tuberculous persons may be taken into active field service and British, French, and German military physicians have given testimony that clinically cured cases should not be rejected. This testimony is quoted and the reports are similar from all the armies in the field where data are available. A former attack of pneumonia should not be cause of rejection for one who has survived an attack is not more liable than others to tuberculous infection. The facts cited seem to show also that military service in the field is not more liable to reactivate dormant or quiescent tuberculosis than any civil occupation requiring muscular exertion and exposure. The morbidity and mortality from consumption in armies which undergo rather strenuous physical strain shows similar testimony. The history of a previous attack of pleurisy or pneumonia in a healthy person should be no bar to military service and chronic bronchitis, pulmonary emphysema, asthma, bronchiectasis, etc., if the heart is in good condition and there are no disabling symptoms should also not be regarded as calling for rejection from military duty. The inquiry into the problem of whether army and navy life during peace times causes a greater mortality from tuberculous disease shows that the dangers are liable to be overestimated. The death rate in the army and in persons of military age in civil life as shown by army and census statistics are decidedly in favor of the healthfulness of army life as regards tuberculosis mortality. It is true that soldiers are apt to be picked men and this in part would justify the difference, but life in the open air, good and nourishing diet, the regular hours and the removal of the deleterious features of city and industrial life are rather a benefit, and there is therefore perhaps even less liability of tuberculosis to the soldier even in active service and there is no evidence of any particular risk from contagion in the army, nor indeed among adults generally, among favorable conditions. As far as the civil population is concerned the facts would not seem to indicate any special danger to the general population from infection from tuberculous soldiers. Available evidence furnished by persons with exceptional opportunity shows clearly that tuberculosis has not changed the morbidity and mortality rates in countries involved in the present great war. The problem of tuberculous infection of soldiers need not be considered seriously. Primary tuberculosis in the military service is rare. Most adults have been infected with tubercle bacilli during childhood and immunized against exogenic reinfection with the same virus, and in the vast majority of tuberculous cases in the war it has been found that they have been infected with the disease before enlistment. Reactivation of all dormant lesions occurs in civil life; it is doubtful whether it is any more likely to occur in military life.—*Tuberculosis and War. M. Fishberg, J. Am. M. Ass., June 16, 1917, lxviii, no. 24, 1791.*

Tuberculosis and War.—Dr. Fishberg's article may admit of erroneous and serious interpretation. His view is that tuberculosis acquired through infection of healthy persons engaged in military service need not occasion any great amount of apprehension or concern. He asserts that in the vast majority of cases of tuberculosis discovered among soldiers it has been ascertained that

they had been affected with the disease prior to enlistment. It is exactly this lighting up of preëxisting disease among the thousands who have been previously infected and not the new infections which is now occasioning concern. We meet occasionally tuberculous persons, even with evidence of active disease, who are able to meet heavy physical demands; and occasionally we come on a patient who appears to improve on account of or in spite of great physical activity. The vast majority of tuberculous persons, however, break down under strain and we cannot differentiate exceptional individuals from their fellows. While it is interesting and surprising that as many as 30 per cent of these men could stand active military service, as seen from the quotation of Banks by Dr. Fishberg, it is more important that over 70 per cent of those who were apparently well enough to be accepted in the army broke down on account of their tuberculous condition. The reactivation of tuberculosis in civil life among those who have been sick with the disease is so great that no one would consider accepting a group of men formerly tuberculous for any important duty involving physical strain. Every tuberculous person or previously tuberculous person enlisted is a weak link in the army, regardless of the apparent condition of the individual.—*Letter to Editor by G. T. Palmer, J. Am. M. Ass. July 7, 1917, lxix, no. I, 59.*

Control of Tuberculosis in Peace and War.—The age at which a tuberculous infection, contracted in infancy or childhood, becomes active is, according to the majority of observers, at or shortly after fifteen years; next between eighteen and thirty years The age at which tuberculosis is diagnosed and apparently contracted most frequently in later life is given as between twenty and thirty-five years. The parent with active tuberculosis should postpone the increase of the family until reëstablished to health. If pregnancy occurs in an actively tuberculous woman the most expert counsel should be sought to decide whether it is safe to allow pregnancy to continue. Special maternity sanatoria for the care of such women and their babies are necessary. Infant mortality from tuberculosis and other diseases is highest in institutions, especially foundling asylums, and this offers a splendid opportunity to childless couples to adopt infants from such sources before they have become infected and thus help in saving lives. Kindergartens are also a source of infection; the private and public kindergartens should correspond at least to the hygiene of open air classes. Well ventilated classes, more recess in the open air, less home work, properly adjusted seats, desks at the proper height, more time for luncheon, and good lunches at cost price can be had everywhere. Weather permitting, singing, recitation, and later, botany, zoölogy, and geology can certainly be taught in the open air. It is more important to teach boys and girls to walk straight, sit straight, breathe deeply and do calisthenics in the open air than athletic exercises which make athletes of only a few and do not benefit the rest. Child labor should have no place in a civilized community and the warring nations regretfully admit that their wholesale exploitation of child workers was a grievous mistake. Legislative action for more hygienic workshops and more sanitary houses for the masses, rational temperance, substitution for strong alcoholic drinks by light beers and wines, compulsury health insurance, limitation of hours of labor and more parks, playgrounds and recreation places for old and young as well as more bathrooms in the houses of the poor and more free public baths, all play an important part in the antituberculosis campaign. In time of war there has been a marked increase in disease in Europe. Let our legislators take timely action that there be enough food and no extortion in food prices so that the strain of war among both civil and military population will not cause a similar increase in this country. If we wish to avoid malnutrition of the masses let us economize on all other things except bread and milk.—*Constructive Suggestions Toward the Control of Tuberculosis in Times of Peace and in Times of War. S. Adolphus Knopf, N. York M. J., June 23, 1917, cv, no 2012, 1181.*

War Measures Against Tuberculosis.—Our entrance as a nation into the war has made it necessary, as probably no other turn of events could have done, to take stock of our resources in all useful activities. We must sort the chaff from the wheat, the luxury from the necessity, the well tried and reliable from the dubious. This is not the time for theory, In the fight against tuberculosis, those measures which are merely theoretically pretty, those which are of dubious value, and especially those which are known to be worthless, should be eliminated.

The essential facts of tuberculosis were recently summed up by Dr. Theobald Smith. We may deduce from this summary certain working principles: (1) There is every reason for continuing adequate rational measures for the restriction of tubercle virus in transit, that is, from sick to well. (2) Logi-

cally the first step in preventing the spread of tuberculosis is to render patients in the advanced cases harmless to others. (3) In the incipient cases they should receive treatment, looking to their cure, and the prevention of their becoming dangerous. (4) Recrudescence from latency is mostly produced by untoward conditions of life which lower general or local resistance. Resistance is kept up by normal conditions of life as regards food, shelter, rest, air, etc. (5) The only increase of resistance which can be achieved by treatment with tubercle bacillus preparations is that caused by the injection of living tubercle bacilli—in other words, "no tubercle, no immunity." "We cannot afford to play with this dangerous method." (6) Tuberculous infection with the bovine type, derived from cow's milk, is not in general a disease concerning human epidemiology, since it is not transmitted from man to man as is the human type. (7) The theory that infection is always obtained in early life has not been conclusively proved.

Translated into terms of action, this means that we must continue to apply well tried rational measures, and in as rapidly widening scope as the increased demands on our facilities will permit. Patients with advanced and dangerous cases must as far as possible be segregated in hospitals, or instructed and supervised. The incipient cases must be detected early and official notification made. Dispensary and sanatorium treatment should be provided. A large part of the increase of tuberculosis noted in those European nations which have borne the severest brunt of the war is contributed by recrudescences in those "cured," "arrested" or "latent" cases in which, under normal conditions the patients would for the most part have continued in comparatively good health. Persons of this class constitute a hard problem for those who will administer the selective draft, either for military or for industrial service. While some patients have been benefited by the outdoor regimen, others have speedily succumbed to the hardship. There is, however, one outstanding fact which we can apply. Unless the population as a whole is well nourished, we may expect an increase in the number of recrudescences. In a short time this will throw on our hands an enormous number of dangerous cases. If we cannot take care of these patients they will play their grave part in the vicious circle of tuberculosis transmission. The European figures available are too fragmentary for definite conclusions, but we should profit by the hint that the fat shortage is perhaps a serious deficiency in the dietary of certain of the stricken nations. To prevent bovine infection from milk, it must be pasteurized or boiled. We cannot wait for the establishment of nontuberculous herds.

So much for what we must attempt to accomplish. It is supremely important that neither time nor money be wasted on methods which have no demonstrated value, or on those which have been shown to be worthless. It would seem scarcely necessary to mention the latter, were it not for the fact that enthusiasts, cranks, and worse than these, are perennially active in trying to secure in influential circles the adoption of various serums, vaccines and other preparations which pretend to prevent and cure tuberculosis. It would appear that certain of these products are being "boosted" by the concerted action of persons who would expect to profit by their adoption. Under the disguise of a scientific or even an altruistic veneer, they advertise their wares in medical journals. The similarity of their phraseology and argument betrays their common interest in a concerted "drive."

We can easily avoid the alluring representations of propagandists of this class—alluring because of the guise of science and altruism which they assume—by holding fast to one fact established by all of the serious work on tuberculosis since Koch, that in order to induce immunity to tuberculosis one must first introduce living tubercle bacilli, and that even this immunity is transient and only relative, and certainly impracticable.

The material reduction in the tuberculosis death rate in the past fifty years has not been due to the use of any serum, vaccine, tuberculin or drug. It has been due to a combination of sociologic, sanitary and hygienic changes, some deliberately planned and others inevitably accompanying what we call "progress." We cannot name or even trace all of these factors, but we can safely attribute much of the improvement to better and more food per capita, better housing conditions, less exposure to hardship, earlier diagnosis and consequently earlier treatment, the growth of the hospital, sanatorium and dispensary idea, better milk, and finally a more enlightened attitude on the part of the public toward the transmissible diseases.

In this emergency we must retain and encourage the intensification of the methods and conditions which have proved valuable in the past, and which no radical innovation has as yet arisen to supplant.—*Editorial, J. Am. M. Ass., June 9, 1917, lxviii, no. 23, 1699.*

Medical Tuberculosis.—Alfaro refers to tuberculosis localized in the lung, pleura or mediastinum. With tuberculous glandular lesions in children there may be merely repeated attacks of croup and spasmodic coughing, or attacks suggesting asthma or a remittent or intermittent fever. After the child is a year old, the affection may be amenable to treatment by change to a mountain climate, heliotherapy, iodin, arsenic and tuberculin. The latter in particular has given him good results when there was little or no fever. Tuberculous glandular lesions are the most readily curable of all forms of tuberculosis in children over 2. In respect to pulmonary tuberculosis, the present status is of less moment for the prognosis, comparatively speaking, than determination as to whether the disease is progressing or not. Hence he classified pulmonary tuberculosis as acute, subacute and chronic, and lists under each of these headings the various types of the disease. The signs and symptoms classified by various authors as signs of incipient pulmonary tuberculosis are usually signs of an old abortive form of the disease. These are the cases that "recover" under any treatment, and that have made the reputation of this or that remedy or course of treatment. The absence of fever, of cough, of tachycardia and other symptoms of tuberculous toxic impregnation show that the clinical findings are the relics of an extinct process, not the warning of an incipient new one. He would reserve tuberculin treatment to cases of nonfebrile fibrous or fibro-cheesy tuberculosis, the chronic pseudo-asthmatic bronchial forms, and the post-pleuritic cortical forms. A very slight subfebrile state does not absolutely contraindicate tuberculin treatment, but it should be given with extra caution and suspended if the febrile reaction is marked. In every attempt to give tuberculin, when there was persisting temperature of 38°C. or rapid pulse, or low blood pressure, the condition was aggravated by the tuberculin.—*Medical Tuberculosis, G. A. Alfaro, Rev. de la Ass. Med. Argentina, April, 1917, xxvi, no. 149, 279.*

Variations in Pulmonary Resonance.—A series of 100 normal chests were examined to determine the significance of variations in pulmonary resonance, in cases in which the question of the presence of tuberculosis of the lungs might arise. Cases with cardiac or pulmonary symptoms were excluded from the series, also those with a history of phthisis, pleurisy, pneumonia, or any abnormality. Obese patients were generally also excluded. The series includes women only, nearly all over twenty years, taken consecutively as they came to the Out-patient Department. The following are the results:

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

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Sworn to and subscribed before me this 3rd day of October, 1917.

RAYMOND G. EHRMAN,
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* "The Choice of Tuberculins," by Benjamin White, Otisville, N. Y., Department of Health, City of New York. Read at the annual meeting of the Medical Society of the State of New York, at Saratoga Springs, May 18, 1916.

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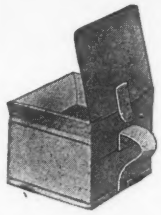

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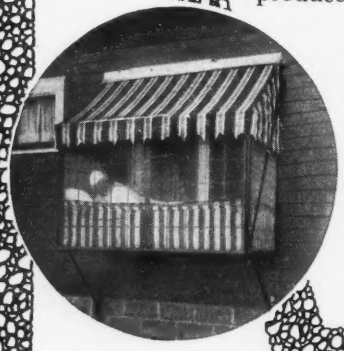

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